Electrical World

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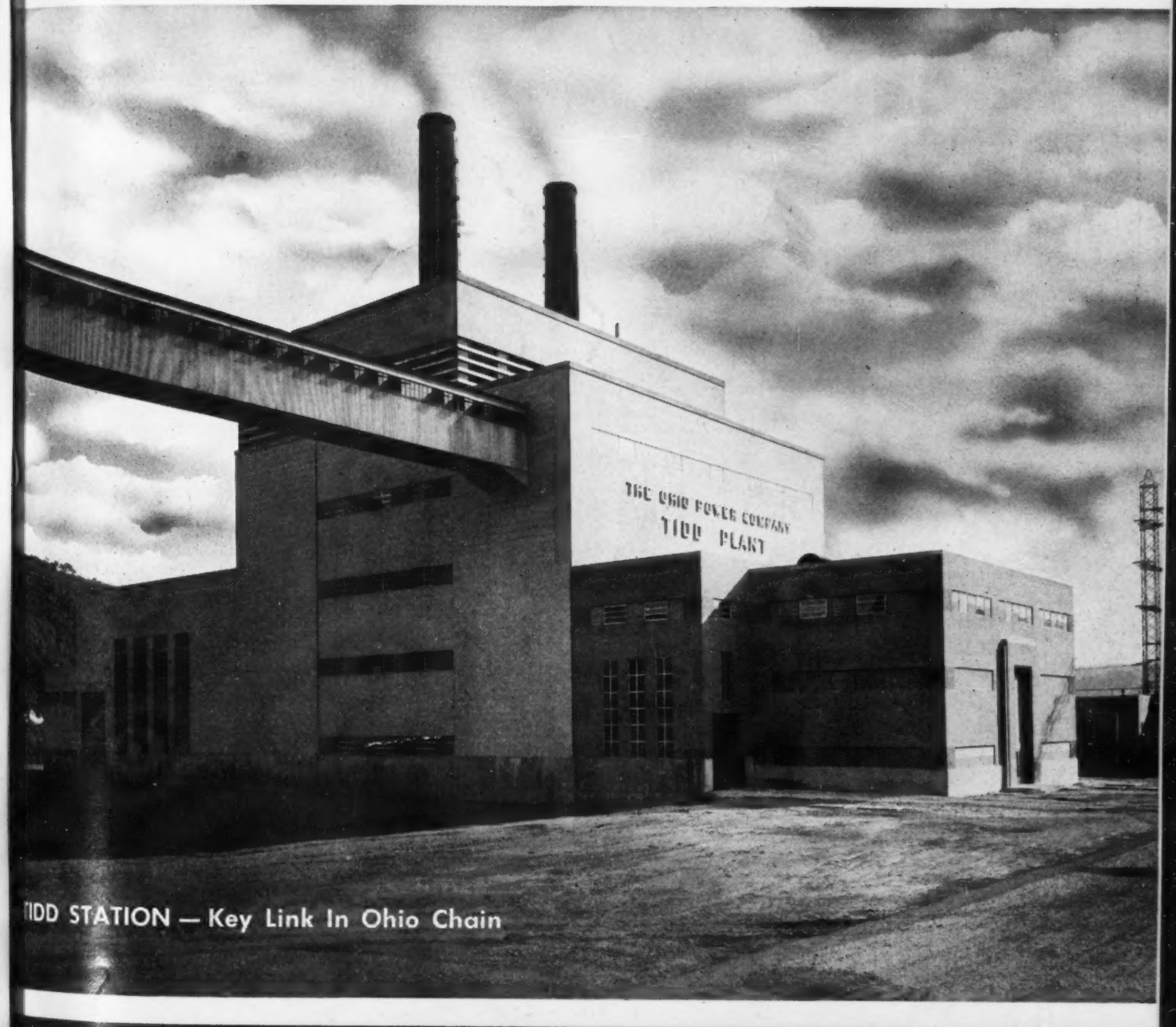

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AUGUST 2, 1947

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Electrical World

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ELECTRICAL WORLD. Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. RETURN POSTAGE GUARANTEED. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. Allow at least ten days for change of address. All communications about subscriptions should be addressed to J. E. Blackburn, Jr., Director of Circulation. James H. McGraw, Founder and Honorary Chairman; James H. McGraw, Jr., President; Curtis W. McGraw, Senior Vice-President and Treasurer; Joseph A. Gerardi, Secretary; Nelson Bond, Director of Advertising; Eugene Duffield, Editorial Assistant to the President. J. E. Blackburn, Jr., Director of Circulation. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Please indicate position and company connection on all subscription orders. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Copyright 1947, by McGraw-Hill Publishing Company, Inc. All Rights Reserved. Cable address MCGRAWHILL, New York. Branch Offices: 520 North Michigan Avenue, Chicago 11, Ill.; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Atlanta, Ga.; Boston, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Washington. Member A.B.P. Member A.B.C.

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Electrical World

AUGUST 2, 1947

Power and National Defense

THE YEARS since the war have seen considerable discussion by a small group of Army men and electric power system experts, representing both public and private ownership, regarding U. S. power supply for the next war. Once again, the topic is receiving attention.

Without concerning itself as to whether there will be another war involving the United States, or when it will come, if at all, ELECTRICAL WORLD welcomes the interest in and discussion of the problem. Planning ahead is basic in the electric power industry. It can only profit from any present-day planning for future war contingency. We have nothing but praise for the war power job which was performed from mid-1941 through mid-1945; but we feel that any of the stringencies of that period—then unavoidable—should be eliminated in any future war if sound planning ahead can avoid them. We feel, also, that the next war, if it comes, will furnish very little time in which to do a war power job of such magnitude.

How then should today's power planning for the next war be accomplished? We believe, primarily, that it should be carried out in the open, and by as broadly representative a group as can be mustered. Certainly, the electric power industry, publicly and privately owned, on a really broad basis, will be an integral agent of such planning. Participation of the armed forces, which are charged with national defense, inescapably will be indispensable. Both factions of the power industry and the armed forces have been engaged in the discussions which already have taken place, although not on nearly so broad a scale as we feel would be desirable.

Next, it seems to us, the state and federal regulatory agencies, which both narrowly and broadly shape the course which power companies must take, should participate. After all, their function is to represent the public interest just as much as the military function is to protect it, and the industry's function is to serve it. We believe that the best plan which the entire industry and the armed forces might devise could easily be thwarted by a failure to include the regulatory bodies, and we believe further that any such bilateral plan might easily be less than the best plan without the advice of the regulators.

Finally, it would seem wise to include the manufacturers of the equipment on which the whole industry will depend to do the next war power job. Certainly a major function of the Office of War Utilities in the last war power job was to work with manufacturers so as to obtain the equipment without which the job couldn't be done. World War II demonstrated that electrical manufacturers are so versatile as to be of tremendous value beyond their immediate fields. If we shall have to spread them thus thin again, they might properly be aware of it and have a voice in how it shall be done.

★ ★ NEWS OF THE

Power Legislation Stalled in 80th Congress Committees

First Session Grants Public Power Agencies All Funds That Can Be Spent in Fiscal Year but Cuts Budget Requests—Bills to Relieve Private Power Fail to Pass Committees

THE Eightieth Congress completed its first session with a generally neutral attitude toward the private vs. public power controversy which had split many of its predecessors.

Funds for many public power projects of the Interior and War Departments were reduced below budget requests. But even ardent boosters of public works spending concede that the Corps of Engineers and the Reclamation Bureau received about all the money for power construction they can hope to spend this fiscal year.

Conversely, dozens of bills—probably more than any Congress has seen in over a decade—were introduced to relieve the electric utility industry. None progressed beyond committee hearings. Most did not go that far. Also, the usual number of St. Lawrence Seaway, "valley authority," reclamation and other public power bills were introduced —with about the same success.

Among the utility-supported measures was the Dondero bill. This would return to the War Department—from Interior —authority to market power from Army hydro projects. Hearings on it were completed, but the bill was far from ready for report. A number of proposed amendments, which are likely to stall the bill next year, were under study.

The House Interstate and Foreign Commerce Committee also deferred final action on the Miller bills, amending the Federal Power Act, after a subcommittee completed hearings. These measures had considerable utility support and endorsement of the National Association of Railroad and Utilities Commissioners. Still they are believed to have little chance of committee approval without considerable amendment.

House hearings were unfinished on the Wilson bill. This would "deauthorize" federal construction of the controversial Clark Hill reservoir and open the way for private construction, as proposed by the Georgia Power Co. Meanwhile, Congress passed an Army Civil Works appropriation including $5,000,000 for continued work by the Engineers on Clark Hill.

Several other bills, with at least limited utility support, failed to be heard. This group included proposals by Sen. Elmer Thomas and Rep. Everett Dirksen to establish a national power policy. Also included was Rep. Oren Harris's bill to limit the Rural Electrification Administration's authority to make loans for power generating and transmission facilities. However, sympathy for such legislation was noticeable. A Senate committee directed REA to account in advance to Congress for all future generating loans.

Two bills introduced by Rep. Hugh Scott, Jr., amending the Public Utility Holding Company Act of 1935, got a brief hearing but were held over till next year.

Utilities took no official stand on the Rockwell bill. Originally this was drafted to clarify amortization provisions of federal investment in reclamation. A watered-down version, permitting Interior to carry on most of its present repayment practices, won House committee approval.

Identical St. Lawrence Seaway bills, imposing tolls, got a favorable Senate committee report. House hearings were half completed. Ardently backed by public power advocates, the bill is scheduled for early votes in both bodies next year.

With Reclamation Bureau support, Senate and House committees approved bills extending federal reclamation laws to Arkansas. They will come up next year, but face rallying opposition.

Of the "valley authority" bills, those of Senator Murray on MVA and Senator Taylor on CVA drew most attention. Their sponsors are planning extensive tours this year, seeking support. No hearings were scheduled on either. Senator Revercomb, chairman of the Senate Public Works committee, announced that he felt no need for an MVA so long as joint Army-Interior plans for Missouri River development progress as at present.

MAKING CHARGES—Joseph Julianelle, business agent of Bridgeport, Conn., Local 203 of the CIO-Electrical Workers Union, tells the House Un-American Activities Committee that half a dozen members of the local and international union are Communists or fellow-travelers

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Distribution Systems Sold

Appalachian Electric Power Co has purchased eleven small distribution systems in southern West Virginia from coal companies for $107,756.57.

ELECTRICAL WORLD ★ ★

FPC's Restriction Leads Utility to Spurn SPA Pact

Texas Power & Light President Wants Contract for Denison Dam Power for no Less than 20 Years

The Texas Power & Light Co has notified the Southwestern Power Administration that the 20-year contract between them concerning disposal of the Texas share of Denison Dam energy has been thwarted by the Federal Power Commission's limited approval of the contract rates.

Recently, FPC approved the contract's rates, whereunder TP&L will market all the Denison energy allocated to Texas. However, FPC confined the approval to a period not extending beyond February 13, 1953, expiration date of FPC's earlier approval of an SPA rate schedule.

In a letter to SPA, TP&L's president, J. W. Carpenter, declared that the 20-year contract made last April contained numerous provisions which were acceptable only on the basis that they—and the rates—would be effective for 20 years. FPC's limited approval, the company made plain, reduces the contract to a day-to-day basis, since many provisions are unacceptable for 20 years if the rates are not to stand for that period. The letter made it clear that TP&L will continue the existing agreement on a day-to-day basis pending a settlement of the problem.

It was believed that the company would insist that nothing in the contract is binding for 20 years if the rates are not binding for that period.

The TP&L-SPA contract provided that SPA could withdraw stipulated amounts of energy from the Texas system for sale to its own customers in Texas. It made thermal-electric generating capacity available to SPA for its own purposes for the first time. Also, it gave SPA the benefits of a substantial transmission system without having to build it. The contract represented substantial concessions by both parties. It did not please certain other power systems in the area. Some of them have since attacked the principle of the TP&L-SPA contract, although FPC disregarded all their protests in giving limited approval to the Texas rates.

Interior Department officials, under whose jurisdiction SPA operates, were reported as upset about the snag in the SPA-TP&L contract as was the company. It was also reported that FPC has no idea of reconsidering the contract rates until February, 1953, or until asked by SPA. FPC has no jurisdiction over the contract other than to approve or disapprove its rates.

HANDICAPPED WORKERS AID UTILITY—Two blind men in the workshop of the Detroit League for the Handicapped salvage machine bolts for the Detroit Edison Co. Seven blind men and two others handicapped in other ways are working 40 hours a week in the League shop salvaging and reconditioning such items as tension sleeves, tap connectors, lag screws, lightning arrestors, cable thimbles, and insulator angle brackets. The utility first hired the workers during the war to recondition appliance cords

Cleaning Up

Household vacuum cleaner sales in the first half of 1947 reached 1,831,840 units, C. G. Frantz, secretary-treasurer of the Vacuum Cleaner Manufacturers Association, has announced. This total is 80 percent of the industry total for entire 1946 and is 9.86 percent more than total sales in 1941.

Dallas Power & Light Co. Expands Expansion Plans

For the second time within a year, Dallas Power & Light Co has announced a $5,000,000 expansion program. The latest addition is to be a 40,000-kw, steam-driven unit at either the Mountain Creek or the Griffin Street plant to cost approximately $4,990,000. The unit is to be ready for the peak-load season of 1951.

Last August, the Texas utility announced that it would add a 30,000-kw unit to its Mountain Creek plant. Early this year it was decided to make this unit one of 40,000 kw. Over $1,300,000 is being spent for two substations.

The utility has a present capacity of 148,000 kw. Since demand has been reaching 160,000 kw, Dallas has been buying power from Texas Power & Light Co and Texas Electric Service Co. Estimates for 1951 demand are 200,000 kw.

Fuel for Atomic Power Plant Expensive Under Present Methods, AEC Reports

Present methods of producing fissionable materials—the muscles of an A-bomb or the fuel of a nuclear heat engine—involve "exceedingly high costs per unit," the Atomic Energy Commission told Congress last week.

There was almost nothing new regarding atomic-electric power in AEC's second semi-annual report to Congress. But the Commission's handling of its limited discussion of atomic-electric power reinforced the feeling which has been growing for some months—that the development of nuclear power reactors is farther away today than might reasonably have been supposed a year ago.

AEC's report cites two main obstacles to atomic power development—the high cost of fissionable fuels and, more immediately, the difficulty of finding suitable materials for high power level reactors. The latter obstacle has been generally known for some time.

Its restrained treatment of the developmental work on power reactors tends to confirm Washington reports of the last several months—that peace-time developments were being subordinated by AEC to weaponeering. Actually, the situation is not so simple. AEC Chairman Lilienthal has often asserted that the work which must be done to use atomic energy is similar for 85 percent of the way whether the goal be a weapon or a non-military application. Thus, to the extent that weaponeering advances the art, some of that advance will be applicable to non-military uses of atomic energy. Rumor has insisted, however, that an increasing amount of AEC's development in recent months has been motivated by a desire to improve the military aspects of atomic energy, and that non-military development has become more of a byproduct.

AEC's second semi-annual report is so phrased as to confirm these rumors. Regarding atomic power the report asserts:

"Large-scale production of power . . . continues to be a major, if long-term goal . . . a number of basic advances in physics, chemistry and metallurgy will be required before power is produced at satisfactory efficiency and cost . . . It is speculative at this stage . . . to estimate how long it will be until power production units feasible for large-scale commercial use will be available. Such power, when attained, will almost certainly supplement rather than supplant water power and power derived from coal, oil, and gas."

Discussing the material difficulties which hamper development of a nuclear power pile, the report added:

"The Commission considers the development of nuclear reactors for power production one of the more important tasks placed upon it by the Congress."

Hungry Horse Dam May Be World's Third Highest

To meet rapidly growing power needs in the Pacific Northwest, the Bureau of Reclamation has changed its plans for Hungry Horse dam in northwestern Montana to make it the third or fourth highest dam in the world, R. J. Newell, regional director, has announced.

After consultation with the Bonneville Power Administration, the Bureau has decided to provide a reservoir on the South Fork of the Flathead River that will hold 3,500,000 acre-ft. of water instead of the 2,000,000 acre-ft. or less originally planned.

The anticipated installed capacity of the power plant to be erected at the dam will be 286,000 kw. Water storage of 3,500,000 acre-ft. will increase by some 334,000 kw. the firm power capacities of existing downstream power plants at Kerr dam and Thompson Falls, Mont., and at Grand Coulee, Rock Island and Bonneville dams on the main Columbia. It would add 477,000 kw. to the firm power capacities of power plants likely to be installed downstream as part of the ultimate development.

A concrete dam approximately 535 ft. high or higher will be required under the new plans, Newell said. The final height cannot be determined until exploration of bedrock and final designs for the structure have been completed. The three highest dams in the world are Boulder, 726 ft.; Shasta, 602 ft., and Grand Coulee, 550 ft.

The enlarged plans were made under the act approving the project, which authorizes the Secretary of the Interior to construct the dam "so as to provide storage reservoir of the maximum usable and feasible capacity."

Pre-construction operations on the project have been under way for approximately two years. The Bureau hopes to begin actual construction of the dam this fall, Newell said.

Seattle Council Approves Higher House-Heating Rate

Approves Plea of Superintendent to Increase Rate of All Energy Used over 1,200 Kwhr to 1.8 Cents

Despite vigorous opposition of the electrical appliance industry, including manufacturers and contractors, Seattle City Council has approved the establishment by City Light of a house-heating rate of 1.8 cents per kwhr after the first 1,200 kwhr per month.

However, residents of the Washington city who are now heating their homes with electrical heaters, and surveys have shown 6,000 homes are so heated, and those who will install such heating before December 31 will be exempt for five years. If a resident who is exempt moves, the new resident will have to pay the new higher rate.

Present electric rates in Seattle are $5 for the first 400 kwhr, 7 mills for the next 2,100, and 9 mills thereafter.

E. R. Hoffman, City Light superintendent, who sought the increase, defended it. He asserted that the charge for house heating is designed to make that class of service pay its own way and not impose a burden on other domestic users.

"City Light is receiving for that part of the energy going into house-heating $15.20 per kw-year while we are presently negotiating a contract for Bonneville current at $17.50 per kw-year. House-heating will add a diversified peak to the system load of about 7.5 kw per home. The city's distribution system, which has cost $23,000,000, will carry a diversified peak of 2.5 kw per home. The cost of rebuilding the system to carry 10 kw per home will be several times the cost of the present system."

Furthermore, Hoffman described use of electrical energy for heating as "not economical at present costs" and added that the city did not have enough power for house-heating and industrial and domestic users. The latter two uses he called the more important.

•

Will Take Over 2 Plants

The Provincial cabinet has granted approval of a British Columbia Power Commission proposal to take over plants at Cumberland and Lillooet.

Cumberland Electric Light Co, Ltd, property and assets serving 750 customers are valued at about $60,000; Pacific Great Eastern Railway facilities in Lillooet, already government-owned, serve 100 customers and provide for irrigation pumps, and are worth some $20,000.

Public Power Appropriations Smother Drive for Economy

Need for Flood Control Brings War Department $502,123,912 Civil Works Bill—Grants Made for Major Hydroelectric Plants—BPA and AEC Get Kind Treatment from Congress

FIVE appropriation bills for federal power projects or for agencies dealing with the electric utility industry zipped through Congress before its adjournment.

The Congressional economy drive all but collapsed under pressure of passage of the $502,123,912 War Department Civil Works bill. The Army Engineers rivers and harbors program received $116,700,000, flood control, $246,072,000.

The House had cut these items to $252,713,500 for both programs. Then President Truman appealed for an additional $250,000,000 for flood control work. Much of the $237,000,000 Mr. Truman sought for the Engineers under this plan was added to the Civil Works Bill by the Senate. Flood control funds for Agriculture and Interior were supplied in a supplemental appropriation bill.

Several major hydroelectric projects of the Army benefited by the Senate's action. Rivers and harbors projects in 30 states and flood control works in 35 were written into the bill.

Funds to start construction of the controversial Oahe reservoir in South Dakota were approved. The bill included $6 000,000, of which $850,000 was to complete plans. Other developments with major hydroelectric plants received the following amounts:

McNary dam, Wash.	$ 4,500,000
Ft. Peck power plant	657,500
Blakely Mountain, Ark.	2,000,000
Bull Shoals, Ark.	6,700,000
Narrows, Ark.	2,000 000
Allatoona, Ga.	8,425,000
Clark Hill, Ga.	5,000,000
Dale Hollow, Tenn.	800,000
Wolf Creek, Ky.	8,000 000
Buggs Island, Va.	4,800 000
Garrison, N. Dak.	20 105,625
Ft. Gibson, Okla.	5 000,000
Ft. Randall, S. Dak.	9,000,000
Whitney, Tex.	5,200,000

Scant funds for power projects of the Interior Department, including $700.000 for Boysen dam, Wyo., were contained in the supplemental bill's flood control totals. Congress cut the President's estimates from $10,000,000 to $6.400,000 for Interior, and from $3,000,000 to $2,000,000 for Agriculture.

Another supplemental bill gave Bonneville Power Administration a windfall, including $1,184,700 in cash and $790,600 in contract authorizations for three Oregon transmission lines: Oregon-Eugene, Eugene-Reedsport, and Reedsport-Coos Bay.

The same bill also contained $489,000 in contract authorizations for BPA to purchase materials and equipment for transmission lines to reach REA-financed electric cooperatives in Idaho's Panhandle.

Final action on other money bills provided funds for key agencies as follows:

Atomic Energy Commission—$250,000,000 in contract authorizations, as requested, but cash appropriations cut from $250,000,000 to $175 000,000, at the insistence of the House. Conferees agreed that the AEC could obtain "whatever may be shown to be necessary for the remainder of the fiscal year 1948" in a supplemental appropriation from the Congress next year.

Securities and Exchange Commission—$5,738,700. Conferees eliminated the $300,000 for collection of "corporation statistics and financial data."

Federal Power Commission—$3,918,000, including a boost of $200,000 written in by the Senate. FPC will spend $226,500 this year on river surveys, largely in cooperation with flood control work of other agencies.

Tennessee Valley Authority—$18,700,000 in new money with $3,253,979 of it earmarked for construction of South Holston and Watauga dams. Another $12,000,000 will be spent on these projects out of reappropriated funds from previous appropriations. With some change in language, but not in intent, Congress accepted the pay-out plan drafted by the House for TVA's power plant.

Also accepted was $900 000 for the Public Buildings Administration to bring SEC and other agencies back to Washington. PBA officials said they expect office space for these bureaus will become available "beginning in September."

BEAR EVIDENCE — Lee Forsythe, Wisconsin Public Service Corp, points out evidence of pole-craving bears which recently feasted on 75 Class 7 poles on the utility's Pickerel, 13.8 kv, single-phase line. Four poles were so badly chewed that stubbing was necessary

•

Congress Retains Subsidy on Non-Ferrous Metals

A bill continuing the premium price plan for copper, lead, and zinc for another two years passed Congress just before the legislators recessed.

The measure provides premium payments for the three non-ferrous metals and for manganese, which was brought under the subsidy in a last-minute amendment in the House, not to exceed $35,000,000 a year for two years.

The plan had been dead for a month before being revived by Congress. During the month-long wait for continuing legislation, thousands of high-cost marginal mines in the West and Midwest were closed. Copper and lead producers were not particularly affected by the evaporation of the subsidy, but zinc producers felt the loss immediately.

The introduction of manganese under the subsidy will mean an allocation of about $1,500,000 the first year and about $3,000,000 the second year for that metal, leaving the rest of the payment authorization to take care of the copper, lead, and zinc mines.

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Fire Damages Iowa Plant

A recent fire which swept through the Peterson, Iowa, power generating plant of the Northwestern Light & Power Co., did total damage of $750,000, according to preliminary estimates.

ADEQUATE WIRING PROMOTION—Over 20,000 persons viewed this adequate wiring exhibit of the Pennsylvania Electric Co. at the Erie Home Show. Members of the utility's residential sales department were on hand to answer questions

Annuities and Trust Funds for Workers Tax Exempt

Payments by the Lincoln Electric Co. for employees' annuity policies and an employees' trust fund were upheld as "necessary and ordinary" within the meaning of the Internal Revenue Code and consequently deductible for tax purposes by a recent decision of the Sixth United States Circuit Court of Appeals.

The decision, which reversed a refusal by the Tax Court of the United States, also held that judicial review of decisions of the Tax Court are governed by the Administrative Procedures Act.

The case concerned almost $2,000,000 which Lincoln put into employee benefits in 1940 and 1941, and which the Internal Revenue Bureau refused to permit the company to deduct from its statements of net income before taxes. Of the total, $975,000 was in premium payments on a group of employee annuities, premiums for which were ruled deductible from 1936 through 1939. The remainder, $1,000,000, was in a trust fund set up by Lincoln for distribution, with earnings, after ten years. It was intended to "provide separation allowances to employees who might be dropped after termination of the war emergency and the reduction in production volume which was expected to follow."

The Circuit Court held that the annuity premiums and trust fund payment might be construed as "ordinary and necessary" under the spirit of earlier Supreme Court opinions when viewed in the light of Lincoln's long-standing profit-sharing, employee-incentive programs. To the extent that they assisted in assuring employee loyalty and efficiency during a time when employees generally were depending more and more on strikes and other forms of union activity, the court held, they were payments prudently made by an employer for the furtherance of an efficient, productive business. On that basis, the court said, they could be considered "ordinary and necessary."

To the extent that other employers can demonstrate a history of profit-sharing and incentive-wage programs such as Lincoln has practiced for years, the decision is considered one of great significance, since it opens the way for tax deductions on two additional types of employee benefit programs.

•

West Texas Utilities Co. Sued by City for $266,000

Damages of $266,000 are asked of the West Texas Utilities Co. in a suit filed at Ballinger, Tex., by the City of Winters seeking to cancel the company's franchise in the city.

The action was filed as a cross action in the suit styled L. A. David and others, against the Universal Electrical Construction Co. of Alabama, Inc., and others.

The City of Winters charges the company with violation of anti-trust laws and of the barratry laws and with attempted bribery. It asks $80,000 actual damages which it stated would have been made in profits from operating an electric generating plant which it charges the utility prevented it from building.

Wisconsin Public Utility Anti-Strike Law Signed

A bill outlawing strikes and establishing machinery for prompt and peaceful settlement of labor disputes in public utilities has been signed by Gov. Oscar Rennebohm of Wisconsin.

The new law prohibits strikes, lockouts, and slowdowns in electric, gas, telephone, communication, transportation, and other public utilities but does not apply to railroads. Nearly all labor unions opposed the bill.

The law provides that the Wisconsin Employment Relations Board within 30 days must name a panel of labor relations experts to serve as conciliators and arbitrators in utility disputes.

In cases where labor and management cannot reach an agreement through collective bargaining, the board will direct one of the conciliators to try to arrange a settlement.

If the conciliator fails to produce an agreement within 15 days, the board will then name three or five arbitrators. Each side will be allowed to strike one name from the list. The arbitrator or arbitrators remaining on the list would then conduct hearings, and the final decision would be binding. Arbitrators would have a maximum of 60 days to reach a decision.

If either labor or management believe the award to be unreasonable, an appeal can be made to circuit court for a review.

Workers striking in violation of the law can be fined up to $250 and imprisoned for a year. Employers refusing to abide by an arbitration award are subject to the same penalities.

89 Loans Sought from REA for Power Generating Plants

Administration Reports to Congress of Loan Applications Totaling $60,000,000 for 375,289 Kw of Added Capacity—Many Requests Will Be Denied—Diesel Plants in Demand

The Rural Electrification Administration told Congress last week that 89 of its borrowers—and prospective borrowers—want loans of more than $60,000,000 for generating facilities.

This information was contained in a list of pending loan applications which REA rushed to the Senate and House Appropriations Committees just a few hours before Congress adjourned last week. The loans would give REA-financed systems more than 375,289 kw in additional capacity.

Submission of the loan data was in compliance with a directive of the Senate Appropriations Committee, which in its recent report on Agriculture Department appropriations, instructed REA to submit to the Senate and House committees reports on all applications for generating loans 30 days before their approval by REA (ELECTRICAL WORLD, July 19, page 73). The agency also will give the committees summary data on every future generating loan application as received.

Since the committees took no action on the first loan list in the last few hectic hours of the Congressional session, and are likely to take none until Congress reconvenes, these applications apparently will be clear for REA approval after August 25—30 days after they were reported to Congress.

However, REA officials asserted in Washington that the agency had no intention of approving all the applications reported. Many, they pointed out, date back to 1940 and 1941, and might well be unrealistic today. They emphasized that REA's major purpose in making the report was to comply with the instructions of the Senate committee.

A number of applications apparently are still in preliminary stages, since the listing noted that several were subject to "further study." Some also failed to indicate capacity of plant or cost figures.

Nonetheless, the report contained much interesting information. Previously, REA had guarded jealously all data on loan applications. The list shows the applicant's name, application date, capacity, type and estimated cost, and an explanation of the reason for the loan. Similar data on future generating loan applications will be filed with the committees, REA spokesmen said.

The list revealed that applications had been received this year for $22,481,700 of equipment with capacity of 126,891 kw. Cost and capacity totals for other years covered by the report are: 1940-41, $6,980,000, 57,072 kw; 1942, $2,260,000, 24,000 kw; 1943, $560,000, 2,800 kw; 1944, $80,000, 234 kw; 1945, $6,826,000, 42,575 kw; 1946, $20,941,270, 121,717 kw.

Most applicants requested loans for small diesel plants or units. Several of the 1947 applications, however, proposed larger steam plants. Among these were the proposal, submitted to REA last May by the Federated Cooperative Power Association and the Central Electric Federated Cooperative Association of Iowa to make a 15,000-kw addition to their existing plant at a cost of $2,750,000. Steam plants of 20,000-kw capacity were planned this year by the Central Iowa Power Cooperative of Cedar Rapids, and by a new co-op in Central Missouri, as yet unorganized.

In July, Dairyland Power Cooperative, Lacrosse, Wis., applied for funds to build two additions to its existing facilities, a 5,000-kw, $935,000 diesel unit and a 15,000-kw, $2,100,000 steam plant.

The bulk of the applicants complained that they needed generating capacity for one of the following reasons: (1) wholesale cost of available power was too high, (2) a temporary power source was needed pending other arrangements, (3) no other wholesale power source was available, (4) to increase capacity of present plants to meet growing demands. Besides these major purposes, a few applicants asserted that present power sources were inadequate or that they needed plants for voltage regulation, as replacement, or as standby for present facilities.

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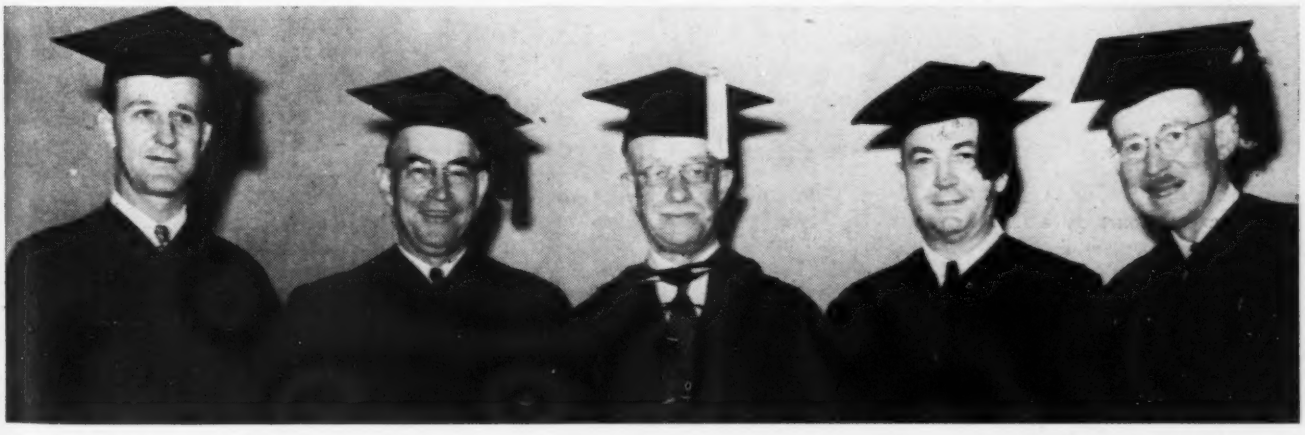
Iowa Franchise Renewed

Battle Creek, Iowa, has renewed the franchise of the Iowa Public Service Co for 17 years.



SCHOLARLY LOOKING—Arrayed in gown and mortar board, these officials of the Puget Sound Power & Light Co recently attended the installation ceremonies for Dr. Raymond B. Allen, president of the University of Washington, at Seattle. Left to right are Emory Branch, director commercial and industrial sales; Charles F. Terrell, vice-president in charge of operations; Dr. Lloyd N. Robinson, associate engineer; Pat Johnson, vice-president in charge of sales and advertising; and Samuel McFadden, consultant

E.E.I. Farm Electrification Training Program Ready

A training program in farm electrification, especially prepared to give agricultural extension agents, agricultural teachers, and rural electric service organization personnel practical information about profitable uses of electric service on the farm, has just been released by the Edison Electric Institute.

The program, as presented in a comprehensive manual, consists of two days of instruction. A complete schedule, with a detailed outline of the subjects recommended and ample reference material for the guidance of those preparing the course, is included in the manual. If local conditions warrant a more extended course, the program is adapted for ready expansion to a greater length.

Among the subjects included are: the present status of farm electrification, basic fundamentals of electricity, wiring and re-wiring for the farm, lighting, water systems, home appliances, electric rates, freezing equipment, electrical equipment for poultry and egg production, dairying and feed and crop processing, and electric motors. The manual presents detailed information on many of these subjects and includes a list of additional pertinent references.

Copies of the manual are being sent to state directors of extension activities, power companies, and others concerned with agriculture, by the Institute. Additional copies will be made available, at $1.50 per copy.

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Clark County PUD Wins Suit to Take Over Utilities

Clark County Public Utility District, Vancouver, Wash., has a right to acquire under a decree of public use and necessity the electrical properties in that county owned by Northwestern Electric Co, Pacific Power & Light Co. and the Portland General Electric Co, the Washington Supreme Court has ruled in an opinion signed by eight of the nine judges, the ninth not voting.

The Court upheld the Clark County Superior Court in a decree handed down in eminent domain proceedings instituted by the PUD.

"If the elimination of private competition constitutes a monopoly, which we do not admit, we are of the opinion" that an earlier decision "holds in effect that a PUD organized under the laws of the state of Washington has the right to monopolize the business of furnishing electricity to the district." the opinion declared.

The court commented that its Clark County decision in no way conflicted with the decision it has reached in the much debated Skagit County PUD-Puget Sound Power & Light Co case, because the proposed Skagit deal was too comprehensive and far-reaching to serve the needs of Skagit County.

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Perjury Charge Brought against Harold Christoffel

Harold R. Christoffel, honorary president of Local 248, UAW-CIO, which has conducted three strikes in the last decade at the West Allis plant of Allis-Chalmers Manufacturing Co, has been indicted by a federal grand jury at Washington. The labor leader is charged with perjury as the result of his testimony before the House Labor Committee in March denying that he had any affiliation with the Communist party.

After Christoffel had testified, Fred A. Hartley, Jr., chairman of the committee, sent a special committee to Milwaukee to investigate. Evidence secured by this group led to the indictment.

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Canadian Output Statistics

The Dominion Bureau of Statistics has released the following output statistics of Canadian central electric stations in thousands of kilowatt-hours:

Period	1947	1946
Four months	15,189,468	13,655,147
Primary	12,319,784	10,177,935
Secondary	2,839,684	3,177,162
Exports to U. S.	689,654	832,627
April	3,727,245	3,[illegible],258
Primary	3,087,231	2,653,715
Secondary	610,014	852,513
Exports to U. S.	186,580	236,170
March	3,956,765	3,[illegible],104
Primary	3,185,451	2,703,095
Secondary	771,314	831,003
Exports to U. S.	183,125	219,274

SEC RULINGS

American States Utilities Co and the Cities Service Power & Light Co have received permission to re-argue certain phases of their dissolution plans. Re-argument was requested, according to the commission, to allow counsel for the companies to present views respecting the effect of the United States Supreme Court's recent decision in the case of the SEC versus the Chenery Corp. The Supreme Court upheld the commission's contention that officers and directors of a corporation who trade in its securities during a reorganization should be permitted to realize only the cost of the securities they acquire plus interest on their investment. SEC granted to American States Utilities the right to re-argue the issue of whether its plan was fair and equitable in its provisions which grant officers and directors of the corporation equal treatment with public security holders. Re-argument was granted to Power & Light with respect to the disposition of an escrow fund representing the aggregate amount that would be paid to its officers if they were permitted to realize profits on debentures and preferred stock of the company acquired since February 24, 1938. (Release No. 7546).

Pennsylvania Electric Co also received an extension of time, until January 2, 1948, to allow the utility sufficient time within which to divest itself of all interest and control over the gas properties formerly owned by the Pennsylvania Edison Co and acquired by Pennsylvania Electric on July 2, 1946. (Release No. 7551).

Northern Virginia Power Co has been authorized to issue and sell 4,630 shares of its authorized and unissued $100 par common to Potomac Edison Co for $163,000. Potomac, a registered holding company, now owns all the outstanding capital stock and long-term debt of Northern Virginia, consisting of 50,370 shares of $100 par common, 1,500 shares of 7 percent preferred $100 par stock and $100,000 principal amount of open account advances. (Release No. 7527).

MEETINGS

Instrument Society of America—Second Annual Conference and Exhibit, Stevens Hotel, Chicago, September 8-12. Richard Rimbach secretary, 1117 Wolfendale St, Pittsburgh 12, Pa.

National Electrical Contractors Association—Annual Meeting, Palace Hotel, San Francisco, September 8-10. C. J. Harder national secretary, 633 Investment Bldg, Washington 5, D. C.

International Association of Electrical Inspectors—Northwestern Section, Eugene Hotel, Eugene, Ore, September 22-24. W. L. Gaffney, secretary, Room 402, City Hall, Tacoma 2 Wash.; Southwestern Section, Mission Inn Riverside, Calif., September 29-October 1. H. G. Ufer, secretary, P.O. Box 6360, Metropolitan Station, Los Angeles 55, Calif.

National Research Council—Conference on Electrical Insulation, Massachusetts Institute of Technology, Cambridge, Mass., September 24-27. Ward F. Davidson, chairman, 4 Irving Place, New York 3, N. Y.

International Association of Electrical Leagues—Annual Conference, Statler Hotel, St. Louis, October 8-11. O. C. Small, secretary, 155 East 44th St, New York 17, N. Y.

American Standards Association—Annual Meeting, Waldorf-Astoria Hotel, New York October 21-23. P. G. Agnew, secretary, 70 East 45th St, New York 17, N. Y.

Previously Listed

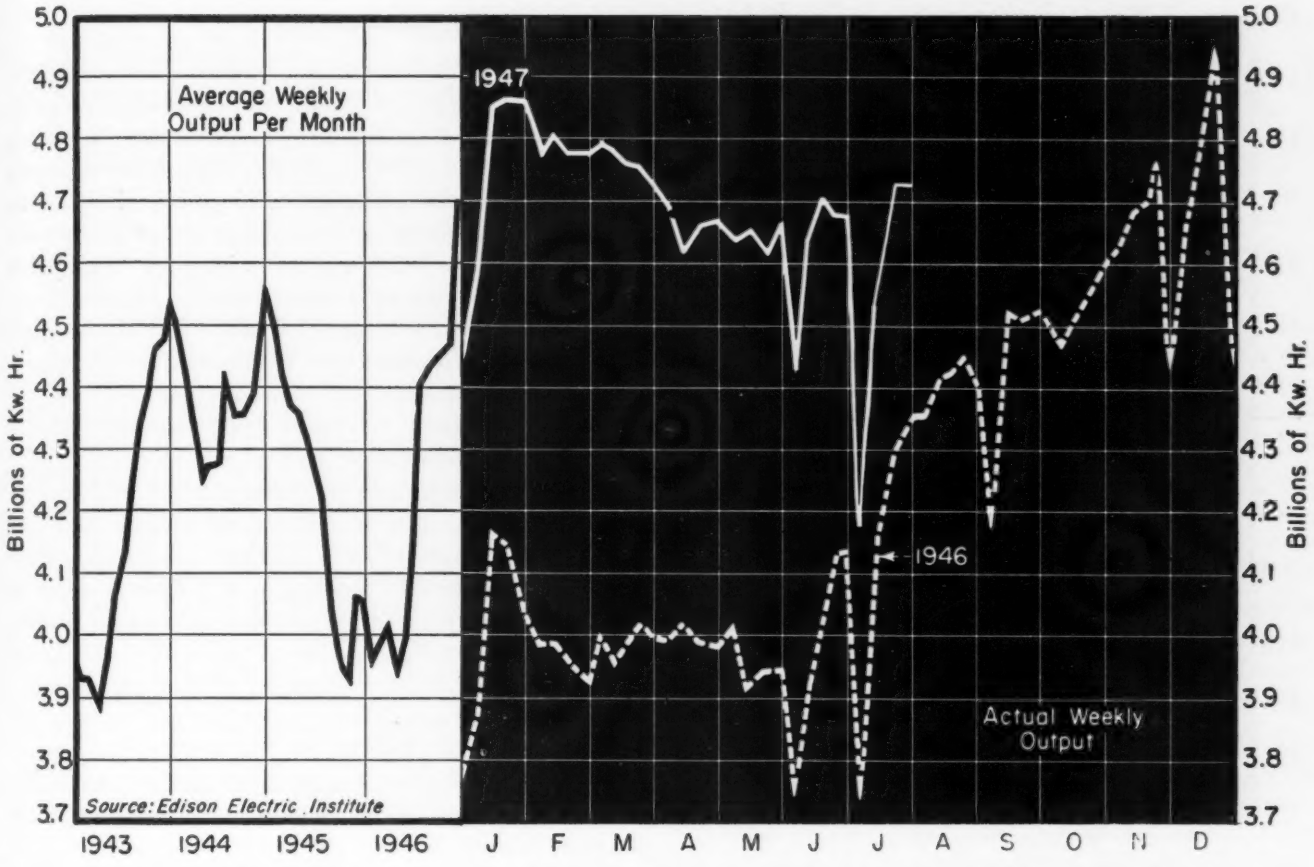
American Institute of Electrical Engineers—Pacific General Meeting, San Diego Hotel, San Diego, Calif., August 26-29.

American Society of Mechanical Engineers—Fall Meeting, Hotel Utah, Salt Lake City, September 1-4.

Illuminating Engineering Society—Technical Conference, Roosevelt Hotel, New Orleans, September 15-19.

Indiana Electric Association—Annual Convention, French Lick Springs Hotel, French Lick, Ind., September 17-19.

National Farm Electrification Conference—Claypool Hotel, Indianapolis October 7-8.


Average Weekly Output Per Month
1947
1946
Actual Weekly Output
Billions of Kw. Hr.
Source: Edison Electric Institute
1943 1944 1945 1946 J F M A M J J A S O N D

Georgia Power Gets FPC License for Hydro Plant

A five-year-old controversy over Georgia Power Co's proposed Furman Shoals hydroelectric project was concluded last week when the Federal Power Commission granted the company a federal license to complete and operate the development.

The license period was fixed at 35 years, apparently in consideration of the fact that Georgia Power began construction of the project in 1929 without federal authorization. The license also includes special provisions requiring the company to alter some of its plans for the project in accord with FPC directions and to comply with navigation and fish protective safeguards as prescribed by the War and Interior Departments, respectively.

Georgia Power stopped construction at Furman Shoals, located on the Oconee River near Milledgeville, Ga., in November, 1930, because of a curtailed demand for power. In 1942 the company filed a declaration of intention to resume work on the project. At the same time, the utility held that the Oconee was not a "navigable stream" as defined by the Federal Power Act.

FPC ruled to the contrary and was upheld by the Fifth Circuit Court of Appeals. The company filed its application for a federal license last June.

Georgia's plans call for erection of an earth-fill dam, 2,780 ft in length, a powerhouse containing two 30,500-hp turbines and two generators of 22,500-kw capacity each. The license calls for resumption of construction within two years and completion of the project within four and one-half years.

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Behling and 3 Nominees By-Passed in Senate Rush

By-passed in the Senate's last-minute sprint toward adjournment were four Presidential appointments of interest to the utility industry. These were the nominations of Burton N. Behling to the Federal Power Commission, and of former Senator Abe Murdock and J. Copeland Gray, as members, and Robert H. Denham, as general counsel, of the National Labor Relations Board.

President Truman is expected to give the same nominees interim appointments which would permit them to serve until Congress reconvenes. They would then be subject to Senate confirmation.

Other News

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Diminishing Margin

The wide margin between the amount of electrical energy distributed by light and power companies in 1946 and that distributed in 1947 is starting to diminish. The 4,730,229,000 kwhr distributed during the week ended July 26 was but 8.7 percent over the 4,352,489,000 kwhr for the corresponding week of 1946. This is the smallest increase reported by Edison Electric Institute so far this year. Output for the previous week in 1947 was 4,732,434,000 kwhr. In the Pacific and Rocky Mountain states output is still running considerably higher than last year, but in New England and Mid-Atlantic areas it is less than 4 percent.

Weekly Output, Millions Kwhr

1947		1946		1945	
July 26	4,730	July 27	4,352	July 28	4,435
July 19	4,732	July 20	4,293	July 21	4,385
July 12	4,531	July 13	4,156	July 14	4,295
July 5	4,190*	July 6	3,741	July 7	3,978
June 28	4,675	June 29	4,133	June 30	4,353
June 21	4,676	June 22	4,129	June 23	4,358
June 14	4,702	June 15	4,030	June 16	4,348
June 7	4,635	June 8	3,920	June 9	4,327
May 31	4,429	June 1	3,741	June 2	4,204
May 24	4,663	May 25	3,942	May 26	4,330
May 17	4,616	May 18	3,939	May 19	4,377
May 10	4,653	May 11	3,911	May 12	4,302

Percent Change from Previous Year

	July 26	July 19	July 12
New England	+ 3.9	+ 3.3	+ 0.1
Mid-Atlantic	+ 3.5	+ 7.6	+ 4.9
Central Industrial	+ 9.3	+11.5	+10.3
West Central	+ 8.2	+ 9.7	+ 7.9
Southern States	+ 8.1	+ 8.5	+ 7.5
Rocky Mountain	+13.2	+17.2	+19.5
Pacific Coast	+15.3	+14.7	+14.6
Total United States	+ 8.7	+10.2	+ 9.0

*Revised

Electrical World
OPINION

Maintaining Public Acceptance

ONE of the more optimistic forecasts of the next decade's prospects for the electric utility industry came recently from Board Chairman H. P. Liversidge, of the Philadelphia Electric Co. With all the discussion there has been of troublous economic times immediately ahead, one would expect so rosy a picture as his to be qualified. It was—but not in the fashion that might have been anticipated. The qualification was based on the industry's ability to keep both hands available for work instead of using them for collective back-patting.

"Most important factor in our rapidly improving picture," Liversidge said, "will be our ability to maintain a favorable public acceptance. If the utilities fumble in the next decade, it will be in this regard. Private ownership of electric power will not be eradicated in the next ten years. During this period the industry ought to be in a better position than it ever was. But we won't reach this goal by taking a rocking-chair attitude. Good customer relations are made and held by hard work, earning the right to get favorable public acceptance. It will never be obtained by a complacent attitude of self-satisfaction or the apparently easy road of reminding the customers by printed word how good you are.

"Good public relations are created in the home—by doing a job for the customers. We can handle this job nicely if we can only imagine what would be the best thing to do when a city full of completely electrified homes finds itself without power."

We believe this optimism will be justified if the industry will take and continue to heed Liversidge's advice—to render the best possible service to the public. It was the attractiveness of its service which gave the industry its start and which developed the industry from nothing to one of the nation's most consequential. It was dependability which nurtured the industry through its years of federal assault, and which enabled the industry to do its war job. No industry which maintains, extends and improves such service will have much to fear from the public, which alone will decide for or against permitting the industry to continue under private ownership.

Highway Right-of-Way

WORD from a small number of Eastern states is that the respective highway commissioners are promulgating rules prescribing more specifically where poles may be placed and where wires may cross. At the moment, the emphasis is placed on the multi-lane arterial highways designed to handle heavy traffic on through routes at fast speed. As one instance, New Jersey appears to have ruled that poles on freeways and parkways shall be further removed from the travelled way and improved shoulder than the two-foot margin previously permitted. The reason for this stand, and for sanctioning overhead wire crossings only at grade separation structures, is presumably a matter of traffic safety or of aesthetic objectives, or both.

Arbitrarily handled, this movement could lead to one of the most onerous and most reliability-weakening restrictions ever confronting the electric utilities and other wire-using companies. Carried to an extreme, it could eventually drive distribution facilities entirely off all the roads in a state and necessitate a technically and financially intolerable number of underground crossings.

There is no reason, however, why consideration of better highway safety should not balance economic gains and losses—take due account of the entailed cost to utility customers arising from such oppressive restrictions on poles and wires.

Right-of-way across country is costlier than ever. A round-about route to reach a stipulated crossing location, a bit of underground to meet the highway commissioner's dictates—all pile up on the cost of rendering indispensable electric service.

The public utility regulatory authorities in the respective states are the watchdogs of consumer interests. It should be possible to count on them to support the utilities in discussions of such highway regulations with the highway authorities. The latter will be better custodians of the cause of the travelling public if they let themselves be guided by the advice of the custodians of the consuming public. It is all one public, anyhow.

What's Ahead for the "Professional" Workers?

ONE of the government men who will have considerable responsibility for administering our new national labor-management relations law believes that "professional" workers may well be more susceptible to unionization under the Taft-Hartley Act than they have previously shown themselves to be.

Any such idea from a qualified source should be of immediate, pressing concern to management of the electric power industry. "Professionals," primarily the non-executive but highly trained group—the accountants, engineers and other specialists—are of tremendous importance to the electric power industry. Under Taft-Hartley, they may not be compelled to join unions representing non-

professional workers. They may join such unions if they choose to, or they may join a union of their own. They may go unrepresented by any union. In the past, of course, it was entirely possible—and not unusual—for professionals to be lumped into unions with other workers whose interests often were remote from their own. This did not encourage unionization of professionals.

Now that professionals are assured they may join a union without its being gobbled up by a production workers' union, this official fears that the professionals may go ahead and join unions—perhaps more readily than in the past. There is, of course, only one answer to this. If professionals believe it in their best interest to unionize, they will do so. (We do not believe such action to be in their best interest.) In this regard, management has a great responsibility. It must take the lead in demonstrating to its professionals that they do not need a union to get what they deserve. This applies not only to money, but to individual recognition, advancement, sympathetic treatment, and all the other things which, properly handled, make for good employee relations, and consequently, for good labor relations.

Another management responsibility is to do something about it now, not some years from now. It will be too late when those who scan the industry for trends report that professionals have deserted their intrinsic stake in management for the immediate but limited benefits of unionism. Then management will have to undo damage which never should have been done.

Survey Incognito

A SURVEY of electric store personnel and methods, recently completed under the auspices of the Electric Institute of Boston, Inc, revealed many things of interest to non-merchandising branches of the industry. With the consent of every store visited, unidentified shoppers called upon over 100 establishments; reported to the owners and the Institute upon their reception, salespeople's alertness, abilities, knowledge and capacities; and then summarized the situation by a point-scoring system. At a metropolitan electrical trade gathering, 500 men and women showed their willingness to take constructive criticisms for what they were worth as they heard the results. The over-all efficiency rating of the 100 stores was 63 percent.

Weak spots in appliance selling were emphasized and the way was pointed toward better methods. In the transition period of the post-war years, it is not surprising that many avenues of improvement were opened. For instance, far better knowledge of products appears essential, and much greater use of manufacturers' and distributors' selling aids was deemed very important. Reports from the field contain many such points of interest to appliance makers and distributors. The Electric Institute of Boston, along with the utilities and manufacturers who furnished the funds for the survey, deserve commendation for good work well done.

WASHINGTON COMMENT

By R. N. LARKIN

AFTER twelve years of the Wagner Act and the admittedly pro-union administration it received, the nation is about to embark on a new tack in federal regulation of labor-management relations. Regardless of the sharp and often bitter opinions which individuals have regarding the efficacy of the Taft-Hartley Act, one can find considerable agreement in every camp that major strikes were becoming too frequent and too serious.

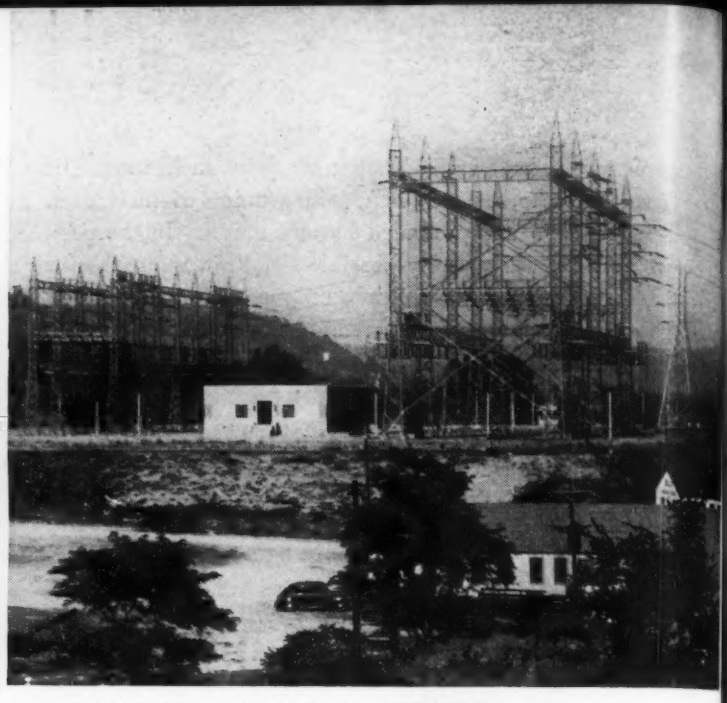
The Taft-Hartley Act, of course, was designed to minimize strikes, whether or not it actually has that effect. At the same time, it was so drawn as to inject the government further into labor-management relations. It follows, then, that the administration of the Act will have considerable effect upon the success with which it be applied. And finally, the men who administer it will have a much greater effect upon the Act's success or failure than might be desirable if it were possible to enact an automatic law—one which would cover every possible contingency and provide, without recourse to human aid, the correct answer to every problem.

Sad to tell, it is considerably less difficult to establish the importance of the new Labor Board's membership than it is to become enthusiastic about the new members of NLRB. Among those who make a business of knowing the labor-management situation—and knowing the people who are big figures in it—there is a disconcerting scepticism about President Truman's new appointments.

One new NLRB member, for instance, is Abe Murdock, former New Deal Congressman and Senator from Utah, whose Congressional record showed strong support for the Wagner Act. The CIO-PAC, basing its judgment on twelve major New Deal issues, gave Murdock a 9 to 3 rating on the New Deal side last fall. Whether the posessor of such a partisan record is a good choice to administer such a policy as the Taft-Hartley Act is a nice question. A lot of people doubt it, particularly when they align Murdock with a reappointed member of the old NLRB, John L. Houston, long considered pro-labor to a pronounced extent.

Reaction to the other new NLRB member, J. Copeland Gray, seems hardly more favorable than that to Murdock —but for different reasons. No one seems to know much about him except that he was an undistinguished industry member of a Regional War Labor Board and the Wage Stabilization Board. Properly or not, the feeling exists that, numerically, the two new NLRB memberships were split evenly between unions and management. Unions got a demonstrated pro-union representative, and management got a distinctly undemonstrated member. Thus, management observers in Washington are restrained about possibilities of improvement under the Taft-Hartley Act.

TIDD PLANT OF THE OHIO POWER CO. Rated for a normal output of 100,000 kw, the first Tidd unit uses two boilers for a maximum output of 120,000 kw



TIDD PLANT SUBSTATION AND SWITCHYARD. The location of this installation makes possible the most economical tie-in to the 66-kv transmission system serving the Ohio Valley

Tidd Generating Station Is

PHILIP SPORN
President
American Gas & Electric
Service Corp, New York

Latest of the power stations to be erected on the system, the Tidd Station, has further widened the base of economical generation. How this was brought about, how the new station is contributing to integrated system performance, and finally, how the existence of the integrated system has contributed to make such a station possible, is an interesting study in the fundamental economics of electrical power supply.

THE CENTRAL SYSTEM of American Gas and Electric Co (Fig. 1) is an integrated power system extending over or into seven contiguous states. It is one of the few large systems that have been approved by the Securities and Exchange Commission as meeting its standards for an integrated system. The SEC order, and findings of approval, issued in 1945, states among other things that:

"The Central System, however, has a long historical record of having been planned, developed and operated as a highly coordinated system. . . ." and ". . . the relatively high degree of coordination of the system's utility facilities and their relatively economical operation . . . have led us to conclude that the system, as presently constituted, constitutes a single integrated utility system. . . ."

Basic character of the system is not only that it serves some 1,800 relatively small communities with an average population of slightly over 1,800, but that it serves some of the most heavily industrialized areas of the country, in which these relatively smaller communities are located, with a fully adequate, reliable and economical energy supply system.

Bases for Economical Generation

Fundamental bases for economical generation can well bear restatement. Briefly they are—

1. Proper site location from the standpoint of area available, water, coal, tie-in to the transmission system, and economical transmission to load centers.

2. Size of units, particularly turbines and boilers, terminal pressure and temperature for the steam turbine, and cycle of operation.

3. Operating arrangements and techniques.

Windsor Plant (Fig. 1) was built in 1917 to supplant local generation with a supply from an economical centralized, modern, mouth-of-mine steam-electric plant. Windsor was not only a pioneering plant from the standpoint of size and type of units and the economical association of coal and water which made possible the development of the site, but by the fact that high-voltage transmission to a principal load center was resorted to and relied upon to assure adequacy of supply.

As the load grew in the Ohio River Valley north and south of Windsor, the capacity which Windsor could furnish to Canton so materially lessened that in 1923 the Philo Plant was started and utilized upon completion as an additional source of supply to Canton. The growth of The Ohio Power Co to a statewide system in Ohio gradually absorbed, however, the output of the Philo Plant and when additional sources of supply were needed for the Central System to take care of loads in Ohio, attention naturally turned to the Ohio River, in the eastern portion of Ohio, as the most logical location where could be found all the essential elements for

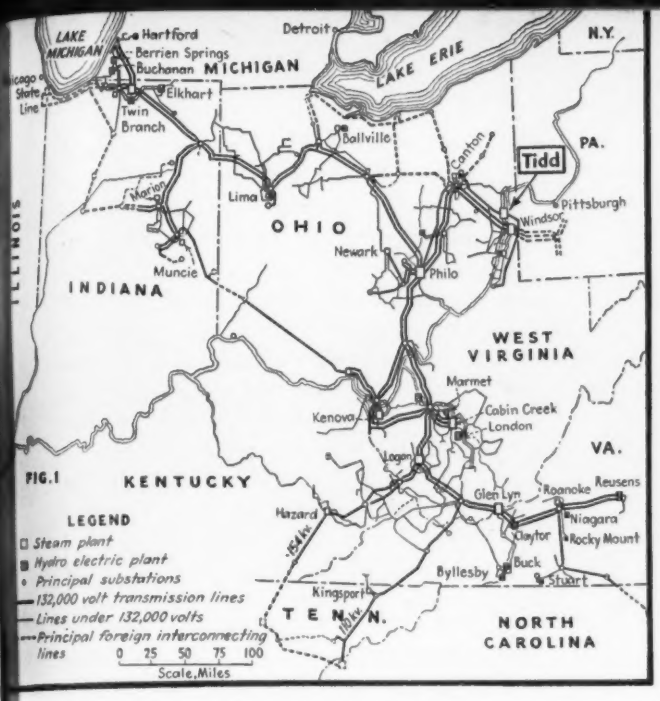


FIG. 1

CENTRAL SYSTEM of American Gas & Electric Co extends over or into seven states. Tidd Plant joins Windsor and Philo near the middle of the load area

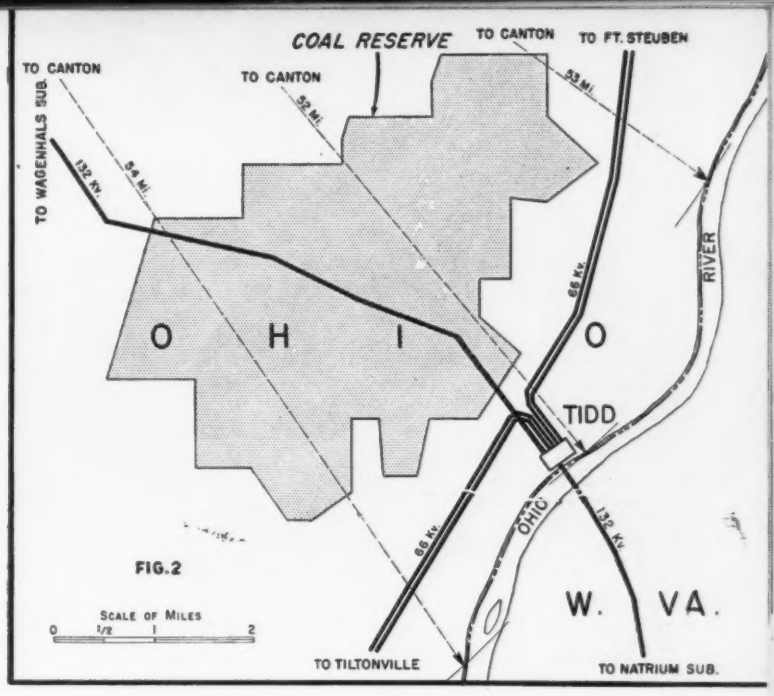


FIG. 2

COAL RESERVES adjacent to Tidd Plant, and shown as the shaded area in the map above, assure an economical supply for the life of the plant

Both Efficient and Economical

economical power generation. The exploration program finally ended with the acquisition of the site of the present Tidd Plant but only after all other prospective sites up and down the river had been explored and abandoned as being too far from one of the principal load centers—Canton—or because they would not make possible the development of an economical coal reserve. Tidd Plant, however, combines within it not only a location that is adequate as to extent of site and the availability of an adequate supply of condensing water, but has also available contiguous to the plant site a coal reserve of approximately 5 million tons of Pittsburgh No. 8 coal, assuring an economical coal supply for the full life of the plant. Fig. 2 fully bears this out.

An important consideration in the choice of the Tidd site was that that particular point on the Ohio River is not only the shortest distance from any point on the river to Canton which was available for development, but that it makes possible the most economical tie-in to the 66-kv. transmission system serving the Ohio Valley between Wellsville, Ohio, and Moundsville, Va. (Fig. 3-A and B).

Thus major economies were brought about not only as a result of the keeping of the cost of transmission features to a minimum, but because the particular method chosen also resulted in the optimum tie arrangements between Tidd and Windsor, achieving minimized effect of the capacity of one on the additions to the short-circuit capacity requirements of the buses of the other.

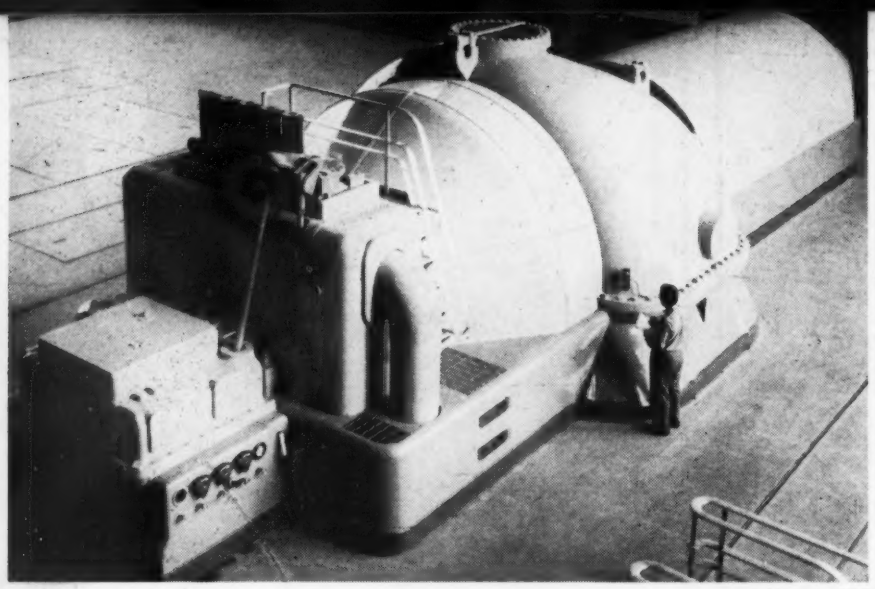
Unit Size, Operation Cycle

Size and type of unit were chosen on the basis of system considerations. Thus, with an expected load of approximately 1½ million kw by the time the first unit was to go on the line, it seemed logical to extend the previous maximum size of approximately 90,000 kw on the system to the nominal 100,000-kw rating of the Tidd unit. The unit, as a matter of fact, was boilered, piped and transformered for a maximum output of 120,000 kw. The capital and operating economies brought about by that size without adding to the burden of system reserves are all directly attributable to the size of the system. The unit itself is a single-shaft, 1,800-rpm unit operating at a pressure of 1,350 psi and 925 deg F. The temperature was lower than was originally intended but was determined by the limitations of a single-cylinder machine of that size, and by the fact that war-time conditions made mandatory the consideration of designs that used a minimum amount of material, and particularly a minimum amount of alloy materials. The original unit placed in service in September, 1945, utilizes two boilers for a maximum output of 120,000 kw. A second unit now in the process of erection has modified this original practice in favor of a single boiler in order to take advantage of both capital and operating economies that such design makes possible. The cycle itself is basically a straight regenerative cycle*, but carried to the point of maximum economy attainable within the range of pressures and temperatures adopted.

Operating Arrangements

All operating arrangements at the Tidd Plant were developed on the

* "The Tidd Plant of The Ohio Power Company," by S. N. Fiala and E. H. Krieg. *Power Plant Engineering*, March, 1947.



GENERATING UNIT is a single-shaft 1,800-rpm machine operating at a steam pressure of 1,350 psi and 925 deg F with a nominal 100,000-kw rating

fundamental basis of achieving the most economical end result not only from the standpoint of capital expenditures but also from the standpoint of operating costs. It was recognized from the very beginning of the design that cost of labor was a significant element that had perhaps previously not been given its full weight. Hence, from the very beginning ultimate manning requirements were given full consideration and no step in design was taken whether it involved location of equipment, choice of equipment, installation of such facilities as elevators or communication equipment, without considering the effect it would have on the operating setup. This eventually led to the adoption of a number of novel design and arrangement ideas, all of which have proven highly effective. Among these design and arrangement ideas that have been adopted at the Tidd Power Station are:—

a. Centralization of control for the unit, involving controls for boilers, turbine, condenser, at a single operating center and the placing of that operation in the hands of a single skillful and well trained operator.

b. Elimination of the control of the transmission system from this operating center. Here the basic idea was that the plant would be confined and limited in its function to generation and the delivery of that generation to a high-voltage bus; the transmission function would be handled elsewhere and would be put on an automatic basis. Details of this will be discussed in an ensuing installment.

c. To the maximum extent possible other operating features were automatized.

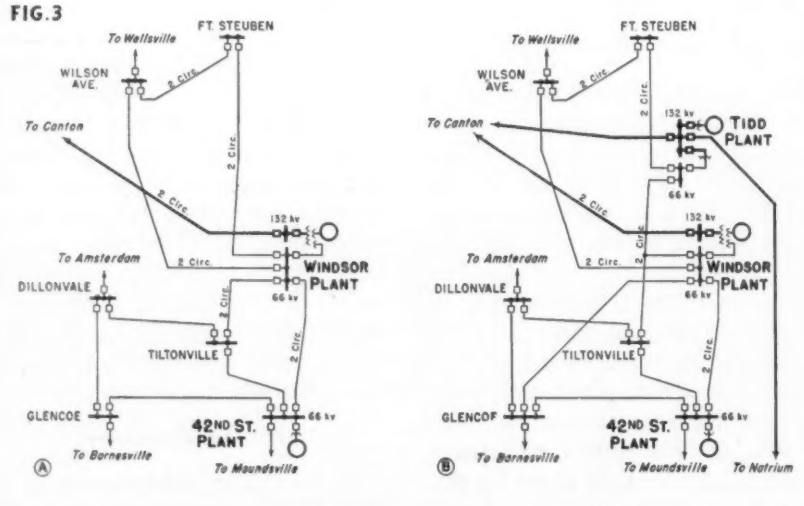
Design and construction features of the Tidd Plant have been described previously elsewhere.†‡ The following comments, however, are pertinent as bearing on the philosophy underlying the whole project.

The essential thing sought in the entire design was simplicity. This was helped materially by the adoption of the philosophy that the plant itself is part of a system and that it did not have to be designed to be self-contained and self-sustaining like a fort in a desert, so to speak. In turn this made possible the elimination of multitudinous duplication of facilities, bypasses, and all the other ramifications which enter a design once the idea of continuity, regardless of what else, is adopted.

It made possible the adoption of the large size turbine-generator. It played a vital part in the simple auxiliary service supply layout. Although not fully taken advantage of in choosing boiler size in the initial unit, it was exploited to the limit with unit No. 2, now in construction, with the adoption of a boiler of 120,000-kw. output. Again, a considerable number of economies, both initial and subsequent, were obtained by adhering strictly to the idea of designing for maximum capability of the turbine unit chosen without adding to nor subtracting from its capability by lavishness or skimping on the sizes or ratings of other items of equipment forming part of the series chain.

Planning on such a basis is not only rational but produces results attested by the fact that on a system noted for its economy of generation, the Tidd Plant is not only thermally the most efficient station but also the most economical one. This despite the fact it is a single unit station, with provision for future expansion, and thereby labors under an ineluctable handicap in almost all its costs elements when compared with stations more fully developed in terms of their ultimate capacity.

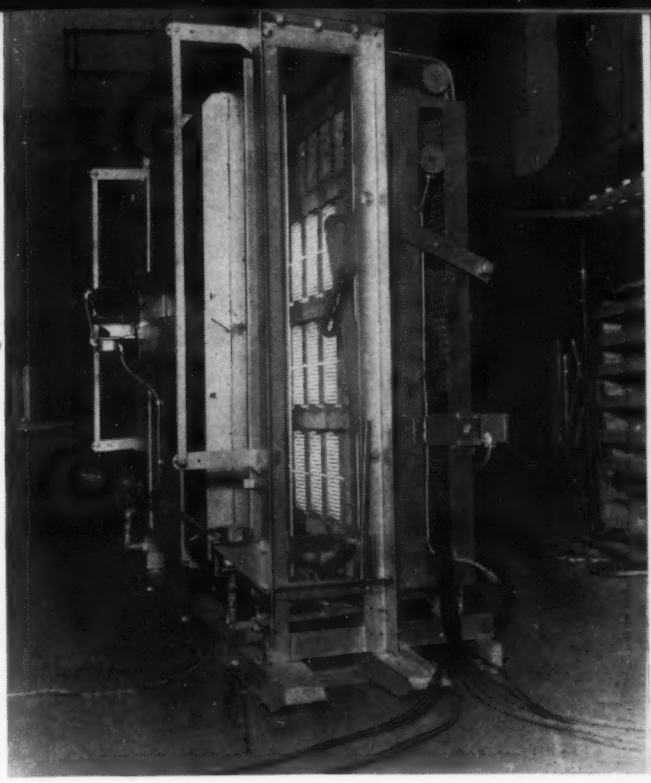
FIG. 3



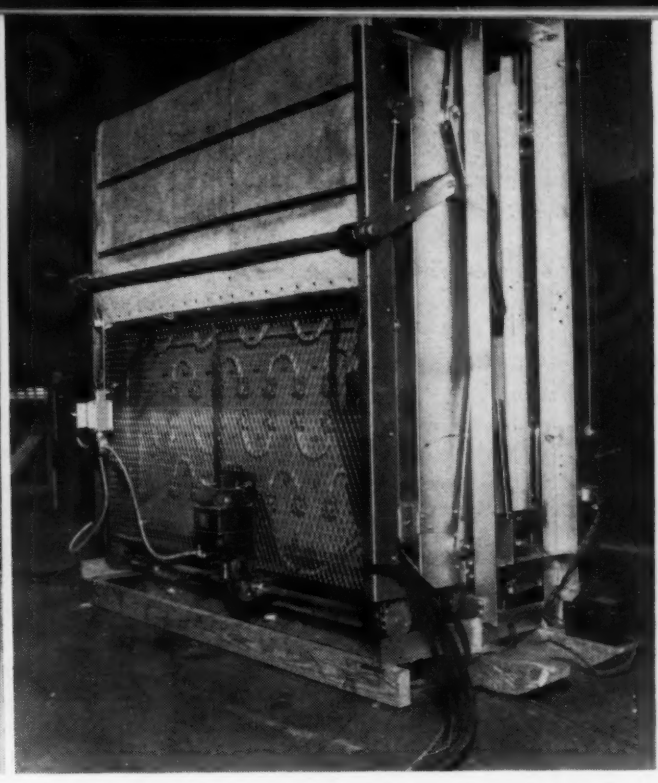
LOCATION OF PLANT permitted economical rearrangement and strengthening of 66-kv sytem supplying Ohio River Valley area. (A) Before Tidd Plant was built; (B) Afterwards

† "Steam Generation at the New Tidd Plant," by S. N. Fiala and L. B. Schueler. *Combustion*, October, 1946.

‡ "Modern Steam Electric Power Station Built on Riverside Site," by H. A. Kammer. *Engineering News-Record*, October 31, 1946.



INK-DRYER ASSEMBLY in open position to show three banks of 2,350-F heating elements totalling 108 kw and fan system for recirculating heated air from top to bottom



SAFETY CURTAIN automatically interposes between heater elements and paper web when press stops to avoid scorching paper. Here it is shown in retracted position

Kilowatts Dry Ink for Fast Printing

E. D. TILLSON
Commonwealth Edison Co, Chicago

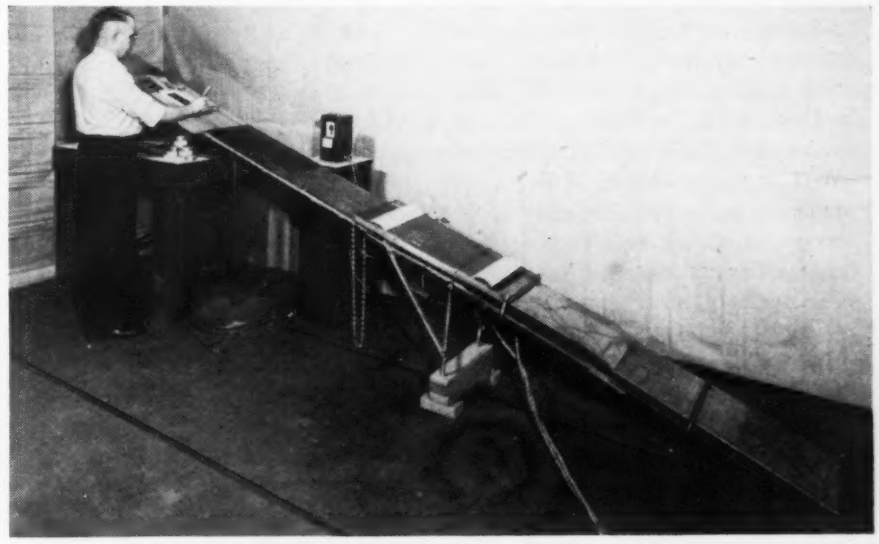
Rectangular grids at 2,350 F offer printing industry safer method than conventional open gas flames . . . Safety curtain protects paper web when press stops

AFTER more than two years of experimenting, Commonwealth Edison Co has developed a high-speed ink dryer in which the resistance alloy, $\frac{1}{16}$-in. square cross-section rod, rests in slots of ceramic plates to form a rectangular-grid panel. The resistors, Hoskins No. 10 alloy, operating at about 2,350 F, form a solid panel except for supporting members made of firebrick.

For many years ink drying for high-speed presses has been accomplished by gas flames or steam. Electric drying by strip or glow heaters has had limited application to low-speed letter presses and duplicating machines, but direct-impinging gas flames are still almost universal for faster printing speeds.

Electric drying offers reduced fire risk from accumulated inflammable coatings inside exhaust ducts and from backfire into gas mixer or carburetor. Electric equipment can also be made more compact by eliminating pumps, blowers, gas mixers and piping, and should be of inherently lower cost. Reduction of paper scorching is also a consideration.

Early experiments started in January, 1945, using an inclosed insulated chute in which a light metal frame carried the inked paper sample past strip heaters laid side by side to form



EXPERIMENTAL CHUTE equipped with 1,500-F strip-heater panel above and below the paper. Electric timer measures speed of inked paper swatch

a continuous heating panel above and below the paper. Speed was timed electrically. Spatula ink "draw-downs" followed regular printers' technique. Two- and three-color work was simulated. Glow plates at 1,500 F were within a half inch of the paper surface.

Representatives of printing establishments made draw-downs using inks suited to high-speed web presses with satisfactory results at web speeds of 250 ft per min using a heat pattern 12 in. long in the direction of travel.

The first design of heater for a 53-in. web press in April, 1945, employed 1,500-F metal-clad heaters of the Calrod type disposed horizontally on 4½-in. centers over a 60-in. span in the direction of paper travel. Each heating element had a polished stainless-steel reflector. An insulating reflector panel faced the reverse side of the paper.

After trial in a local printing plant in the fall of 1945, it was found that a fine light-colored dust quickly reduced reflecting value of the steel. Also, at high speed, cold air drawn into the dryer by the surface nap precluded satisfactory drying.

Rebuilding the heater for 2350-F temperature increased electrical input from 35 to 108 kw. Also, an arrangement of ducts and blower draws heated air from the top of the inclosure for return to the bottom to avoid considerable losses found in the earlier model. Air should be heated to about 800 F and paper to about 300 F for proper drying of the ink.

Heater panel and reflector panel in the present dryer are about 1 in. apart when paper is moving through, but can be separated by several inches when desired. To avoid scorching while paper is at rest or moving slowly, a heat-resisting curtain, asbestos faced with treated glass-fiber cloth on a flexible woven stainless-steel belt, is automatically interposed between heating panel and paper.

The heat-insulated back of the reflector panel carries an arrangement of ducts and a blower to draw heated air from the top for return at bottom. Flexibility in temperature control is assured by dampers. Air from left top can be shunted to right bottom or vice versa as required.

To counteract the tendency to overheat at the center of the bank, provision is made for short circuiting any or all center elements. Future plans include use of saturable-core transformers with thyratron control.

Utilities Try Mobile Phone Channel

Mobile communication to any telephone . . . Eliminates special operation and maintenance arrangements . . . Service introduced in St. Louis and other cities during past year

H. P. LAWTHER
General Engineering Dept
Southwestern Bell Telephone Co
St. Louis, Mo.

TELEPHONE communication between a motor vehicle and any other telephone—not confined to a special operator or dispatching office, and with all facilities furnished and maintained on the regular telephone basis—is a service now coming to be rather widely available to electric and other utilities. Beginning at St. Louis in June, 1946, the Bell System Companies have similar installations completed or under way in 48 cities, and plans are being made to provide this service at many of the remaining larger cities and over a number of the important highway routes of the country.

This telephone service is classed as "experimental" at present, and is an exploration into a new form of service offering by the Telephone Companies. Much experience must be gained before users' requirements and technical possibilities can be thoroughly developed and adjusted to each other.

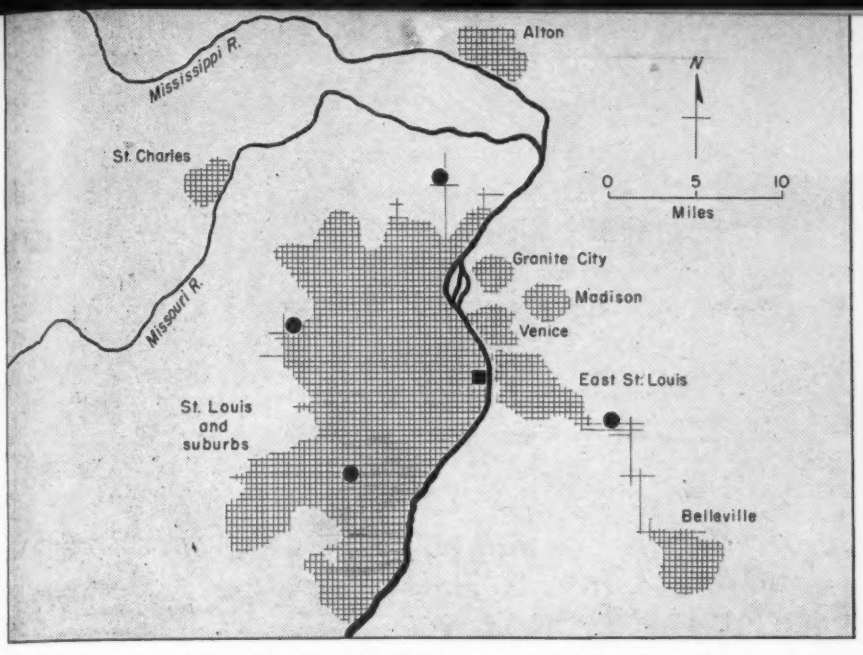
The largest customer at St. Louis is the Union Electric Co of Missouri —with 20 of its cars and trucks now equipped, and with 27 additional units ordered for the coming second and third channels. This company decided that the new service would be a useful supplement to the private mobile system it has been operating for some time, and is carrying out a full-scale program to develop its possibilities in their operations.

Use Same as Telephone

The driver of a motor vehicle turns a control switch to the "on" position to place the radiotelephone equipment in the receiving standby condition, which is indicated also by a small lamp on the face of the unit. When he desires to place a call he withdraws the hand-set from its rack and listens to be sure the circuit is not busy. He then depresses momentarily a push-button on the hand-set handle, and listens for a response.

This operation causes the car transmitter to be energized, and when its radiated energy reaches any suitable land receiver at workable strength, a signal is brought in at the telephone switchboard. The operator there answers and handles the call in the customary way—with the result that the car occupant can talk to any other telephone anywhere, including another mobile telephone. The car telephone differs from the ordinary telephone only in that the user must press the pushbutton while talking, and release it while listening.

When a person at any telephone wishes to call one of the mobile telephones he reaches the long distance board in the usual manner and asks for the Mobile Service Operator. This operator dials the code number assigned the called car. Pulses radiated from the land transmitter cause a bell to ring briefly in the control unit of the called car, and a red signal lights and remains lighted until the hand-set is taken from its receptacle. This last is an important feature for driv-



LOCATION OF CENTRAL TRANSMITTER and receiver (square symbol) and four outlying receivers in local mobile service area at St. Louis

UNION ELECTRIC CO truck equipped with telephone channel mobile radio unit

ers who have to work away from the car, as they thus can be notified to call the operator when they return to the car.

Some Important Facts

The Federal Communications Commission has allocated the frequencies available for mobile service into two classifications, urban and highway. Urban frequencies (152-162 mc) are to be used in serving a metropolitan area, while highway frequencies (30-44 mc) are to be employed in covering the inter-city areas.

With either urban or highway mobile service a fairly elaborate installation of land elements is necessary. A transmitter (usually 250 watts), or a series of transmitters, must be located so as to produce over the region to be covered a radio field-strength sufficient to assure satisfactory reception by a mobile receiver unit anywhere in the region. Several land receivers normally are required, spaced over the area covered by a land transmitter, because the comparatively low-powered (usually not more than 30 watts) mobile transmitters with their less effective antennas cannot achieve the working range of the land station. From each land transmitter and its associated receivers land-wire lines must be brought in to a control terminal where the two directions of transmission are combined and extended to an appearance on a regular telephone switchboard.

The car installation consists of transmitter, receiver, and selector units which usually can be mounted in available compartment space, and a small control unit (including a receptacle for storing the hand-set telephone when not in use) which can be mounted under the dashboard. Transmitter and receiver share a single antenna. The 152-162-mc antenna is about 18 in. long, and can be mounted to be quite inconspicuous and to present no clearance problem. The 30-44-mc antenna is around 6 ft long, and it is not easy to mount this so satisfactorily. Ordinarily the regular generator and battery of the car must be replaced with heavy-duty types, and interference suppression equipment may be required. Car owners are expected to provide the adequate generator and battery equipment.

Party-Line Service at Present

For very practical reasons—not the least of which is the scarcity of available frequencies—it is necessary for mobile service to be given today on a multi-party-line basis. At St. Louis only one channel has been operated thus far, and by the end of 1946 the number of mobile units sharing this had been increased to 70—with a satisfactory grade of service still being had. It is an important part of the "experiment" to determine the traffic load offered by the new service, and how this is distributed over the day. Much more experience must be accumulated before trustworthy inferences can be drawn.

With present circuit and equipment arrangements, any of the mobile units can listen in and hear both sides of any conversation on the channel. Users of the service must recognize that a radio link is involved, therefore, and must observe the Commission's Rules relating to the use of objectionable language and to the confidential nature of any disclosures they may overhear.

Not a Plaything

At St. Louis at this time the rates (and these are experimental, too) for "general" service are: An installation charge of $25 and a monthly charge of $15 for the mobile equipment, and a minimum monthly charge of $7 covering 120 local message units—with 5 cents for each additional message unit. A call requires a minimum of from 6 to 8 units depending upon the location of the land telephone within the local mobile service area. Regular established person-to-person day toll rates are additional with calls between a mobile unit and telephones beyond the local mobile service area. For some users the "dispatch" service or the "signaling" service offerings may be attractive.

An operator of a large fleet may find his requirements met best by a private mobile system furnishing telephone communication between his offices and his vehicles only. If such an operator can qualify to obtain a permit from the Commission, the Telephone Companies will furnish, install, and maintain all facilities on a rental basis.

CONCRETE PUMPING STATION 4 miles out in Lake Okeechobee is operated and supervised by 45-kc carrier signals from water treatment station 7 miles away. The relative inaccessibility made it desirable to have the station unattended

Carrier Controls Lake Water Pumps

W. A. DERR
Switchboard Engineering Dept
Westinghouse Electric Corp
East Pittsburgh, Pa.

and

W. A. KELLER
Southeastern District
Westinghouse Electric Corp
Atlanta, Ga.

and

H. A. W. HEDKE
Electrical Engineer
U. S. Sugar Corp
Clewiston, Fla.

CARRIER CURRENT was found to be the most economical solution when the U. S. Sugar Corp at Clewiston, Fla., was faced recently with the problem of controlling the operation of a pumphouse located out in the waters of Lake Okeechobee, four miles from shore and a total of seven miles from the point of utilization.

The pumping station is equipped with two pumps, one rated at 2,800 gpm and driven by a 75-hp electric motor and the second a 5,600-gpm pump driven by an 180-hp gasoline engine. Either pump can carry the load alone, although generally it is more desirable to use the electric motor.

These pumps must be started and stopped according to a definite schedule and their operation supervised at all times. The rate of water pumped must be known and a means of communication must be provided with the mainland. The relative inaccessibility made it undesirable to station an operator at the pumping plant. Although the 4-kv electrical supply wires (Fig. 1) are all in buried cable, four miles of which lie under the surface of the lake, carrier current was decided upon as offering more advantages than control wires.

Power-line carrier equipment is usually operated over high-voltage, open-wire lines. While the attenuation found in power cables is exceedingly high, carrier over cable is practicable when the distance involved is not too great.

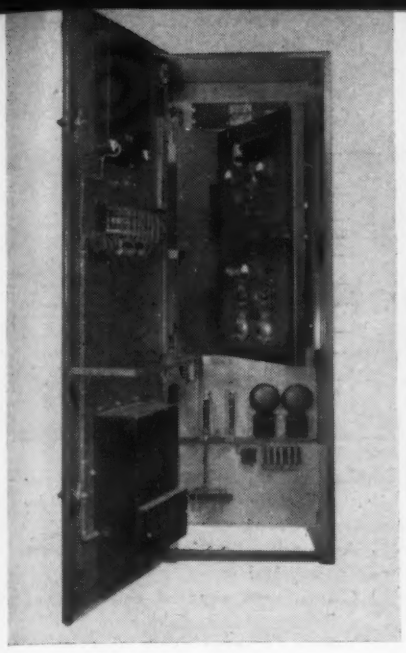
The Okonite power cable used at Clewiston consists of a 22,800-ft length of armored, submarine cable running from the pumping plant to the shore and a 12,200-ft length of rubber-jacketed cable from the shore to the water-treatment plant. Both lengths of cable have No. 4 conductors. The characteristic impedance of both types of cable is approximately 85 ohms line-to-line and 45 ohms line-to-ground. Fig. 2 shows curves of attenuation for the cable covering the range of power-line carrier frequencies.

Carrier Transmitter

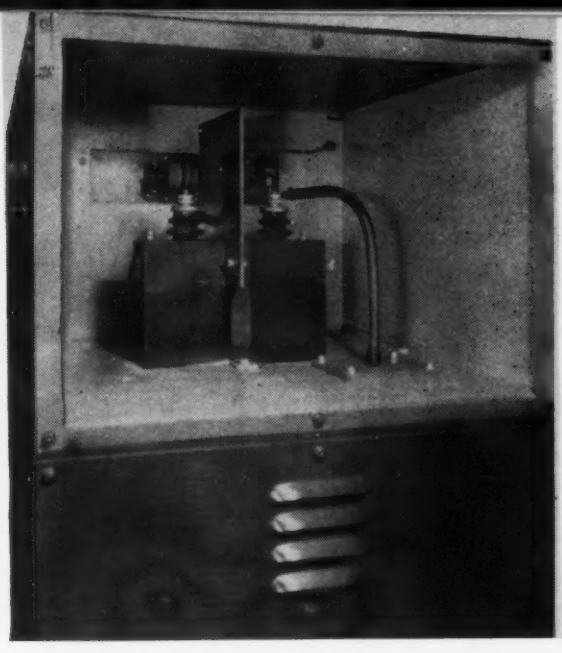
The power-line carrier equipment is made up of individual panels, the number and types being determined by the functions performed. A transmitter panel, receiver panel and modulator panel were used for the water treatment plant and the pumping station. A view of the panel wiring of the transmitter modulator and receiver is shown.

Carrier transmitters and receivers are adjustable over a frequency range from 45 to 165 kc. The carrier equipment can be operated at from 100 to 150 volts d-c. On this installation 125-v batteries are used to supply power. When operated at 125 v, the transmitters have a nominal power output of 15 w. Operation is possible with a signal attenuation of 30 db.

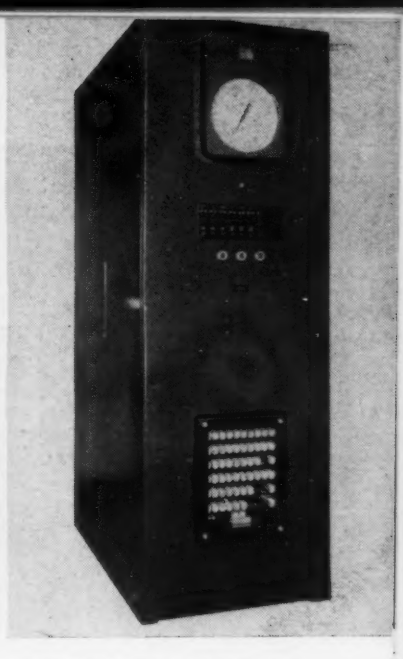
Transmitter panel consists of a Colpitts oscillator (one tube) and a six-tube push-pull amplifier. The amplified carrier frequency output is fed into an iron-core radio-frequency transformer whose secondary couples the carrier to the line through the coupling capacitor. The transmitter output circuit will match impedances



CARRIER EQUIPMENT mounted on swinging panel to facilitate maintenance. At top, the transmitter; in center, the modulator; at bottom, the receiver



STANDARD 2.3-kv distribution capacitors introduce low capacitive reactance, eliminating the use of line tuning unit. The small size of the capacitor presented no difficulty in mounting it in the switch-gear units



SUPERVISORY CONTROL and carrier equipment housed in metal-clad cabinet located ashore at water treatment plant

Over 7 Miles of Cable Circuit

Practicable adaptation of 45-kc carrier to 4-kv submarine cable affords supervisory control, telemetering and communication to unattended pumps out in lake . . . Achieved for this distinctly low voltage without resort to line tuning unit

that range from 30 to 1,200 ohms.

Carrier Receiver

Receiver panel contains a biased detector which is saturated when a satisfactory or stronger signal is received. Thus, the plate current of the receiver is not materially different for wide variations in received signal strength. The carrier frequency input is fed through a primary tuned circuit that is coupled to a secondary tuned circuit. The secondary circuit delivers the carrier-frequency voltage to the grid of the detector tube of the carrier receiver.

The output of the detector supplies rectified current for the supervisory-control receiver relay. The receiver relay is of the same general type as the rest of the supervisory-control relays and is mounted in the supervisory-control relay case.

Modulator panel includes the matching transformers, resistors, and relays for modulating the transmitter for voice communication, for matching the carrier receiver to the telephone receiver, and for inserting attenuating resistance in the receiver circuit for voice communication.

Design of the supervisory-control equipment used on this installation is based on single-frequency operation of the carrier sets. That is, the transmitters and receivers at both locations are operated at the same frequency. Since the attenuation in the cable is considerably less at lower frequencies, the equipment is being operated at a frequency of 45 kc.

TABLE I.
Capacitance and Reactance of Coupling Capacitors

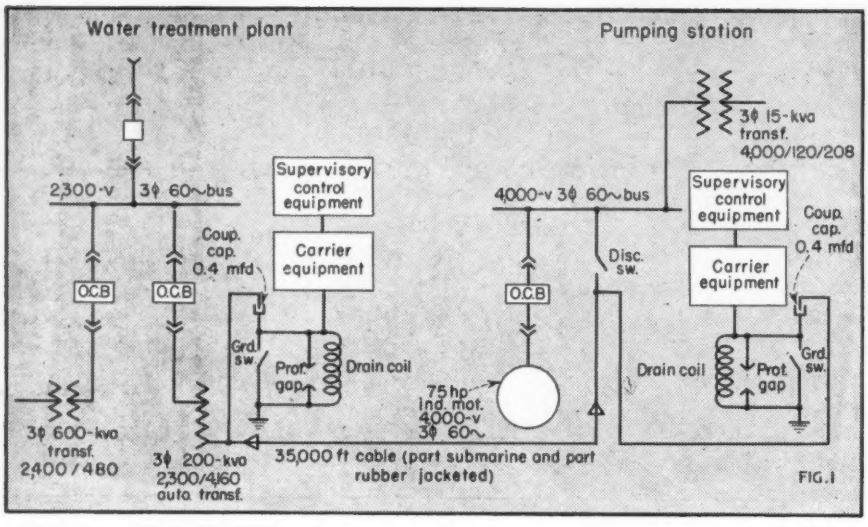
System Voltage Kilovolts	Coupling Capacitor Value Microfarads	Ohms Reactance at 50 Kilocycles
15	0.01	320
23	0.0075	430
34.5	0.005	640
46	0.004	800
69	0.00275	1160
92	0.002	1600
115	0.00187	1700
138	0.00137	2320
161	0.00125	2550
196	0.00094	3390
230	0.00094	3390
287.5	0.00075	4250
345	0.0006	5300

Carrier Coupling Equipment

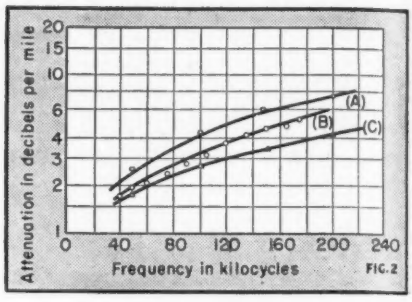
Power-line carrier sets are usually connected to power lines through standard carrier coupling capacitors manufactured for a voltage range from 15 kv to 345 kv. These have low capacity values since the size of the units is held to a minimum. But high capacitive reactance is found with these even for the carrier frequencies from 45 to 165 kc. Table I shows the values of capacity and the capacitive reactance at 50 kc for the standard line of coupling capacitors.

A line tuning unit is used with these carrier coupling capacitors for cancelling the high capacitive reactance so that the carrier sets can operate into a circuit which is essentially resistive to provide the most efficient use of the power output of the carrier transmitters. Also, if the circuit is not essentially resistive, harmonics of the carrier frequencies may result which can cause interference in the radio broadcast range starting at 500 kc.

The best arrangement for the Clew-



SIGNALS FOR CONTROL from shore station are conveyed by carrier over cable supplying power to 75-hp motor driving the pumps. Total distance is 7 miles



CABLE ATTENUATION in decibels per mile. (Factory test data supplied by the Okonite Co)
(a) Armored submarine cable, line-to-line, factory test
(b) Combined armored and jacketed cable, line-to-ground, field test
(c) Rubber jacketed cable, line-to-line, factory test

iston installation was to have the entire carrier and supervisory control equipment incorporated in the design of the metal-clad switchgear at both locations since the power cable was to terminate in the metal-clad switchgear assembly at both the water treatment plant and the pumping station. The smallest standard carrier coupling capacitor available was for use on 15-kv lines. This coupling capacitor was of such size that it could not have been readily incorporated in the assembly of metal-clad switchgear. Also, as will be seen from Table I, the capacitive reactance of this coupling capacitor at a frequency of 50 kc was 320 ohms. Since the characteristic impedance of the cable from line-to-ground is only 45 ohms, a line tuning unit would have been required to cancel the capacitive reactance.

No Line Tuning Unit

Since the carrier equipment was to be operated from line-to-ground, it was decided to use a 2,300-v insulation-impregnated capacitor similar to those used for power-factor correction, to couple the carrier equipment to the power cable. The capacitor has a capacity of 0.4 microfarads and a capacitive reactance of only 8 ohms at a frequency of 50 kc. Since this value of capacitive reactance is low with respect to the 45 ohms characteristic impedance of the cable, it was not necessary to use a line tuning unit.

The small size capacitor presented no difficulty in mounting in the high-voltage compartment of the metal-clad switchgear units housing the carrier and supervisory control equipment at both the water treatment plant and the pumping station. The small capacitor mounted in the metal-clad unit at the water treatment plant is shown. The carrier protective panel which mounts the drain coil, grounding switch, and protective gap indicated in Fig. 1 can be seen on the barrier between the high- and low-voltage compartments of the metal-clad unit in the photograph.

Supervisory Control

Supervisory control equpiment on this installation is of the all-relay type. The equipment automatically generates and receives coded impulses to perform the functions of selecting the apparatus to be controlled, performing the desired operation, and indicating that an operation has taken place. The equipment employs a positive check for each selection made, this check being a duplicate code which is returned from the receiving station. The impulses are transmitted at the rate of 15 per second with all selection and control impulses being of the same duration.

There is an individual key and lamp plate or escutcheon provided for each function performed by the supervisory control equipment. The keys for selection and control of the remote unit and the lamps indicating the position of the unit are mounted on the escutcheon.

Carrier impulses are transmitted by having the supervisory-control impulsing contact close the carrier keying circuit. All carrier impulses originated at either the water treatment plant or the pumping station operate the receiver relay at both locations since both transmitters and receivers operate on the same frequency.

A metal-clad unit at the water treatment plant houses the supervisory control and carrier equipment. A similar control relay case is located at the pumping station. The supervisory control equipment provides the following services on this installation:

(1) Start, stop, and supervise electric motor.

(2) Start, stop, and supervise gasoline engine.

(3) Control and supervise automatic-manual transfer.

(4) Supervise electric motor annunciator.

(5) Supervise gasoline engine annunciator.

(6) Supervise burglar alarm.

(7) Selective telemetering of rate of water pumped.

(8) Establishment of communication circuits.

Control of Pump Drives

Automatic or manual control of the electric motor and the gasoline engine is provided by a latch-type relay at the pumping station that can be controlled from the water treatment plant by the supervisory control equipment or by means of pushbuttons at the pumping station. The supervisory control equipment provides a continuous indication of the position of the latch-type transfer relay, in addition

to indications as to whether or not the electric motor or gasoline engine are running. When the latch-type transfer relay is in the manual position, the electric motor and the gasoline engine can be controlled independently either through the supervisory-control equipment or from pushbuttons at the pumping station. Thus they will continue to run when started, until stopped from either location or by means of protective equipment.

When the transfer relay is in the automatic position, either the electric motor or the gasoline engine will pump water if conditions are satisfactory for either to operate, with preference being given to the electric motor. The electric motor and the gasoline engine will never both operate at the same time with this setting of the relay. If the motor stops as a result of lack of voltage or through action of the protective relays, the gasoline engine will automatically pick up the load until such time as the motor can operate again.

Supervision of Drivers and Alarm

Various trouble conditions at the pumping station of either the electric motor or gasoline engine operate two annunciators, one annunciator being assigned to the electric motor, and the second to the gasoline engine. The alarm contact on each of these annunciators is connected to the supervisory-control equipment.

When the alarm contact on either of the annunciators closes, the supervisory equipment immediately reports this condition to the water treatment plant, where an alarm bell is sounded and a lamp is lighted to indicate operation of that particular annunciator. Thus, the operator is immediately made aware of trouble conditions on the electric motor and the gasoline engine.

Entrance of anyone into the pumping station interrupts a beam of light associated with a photoelectric cell. This results in a signal being sent to the water treatment plant by means of the supervisory control equipment. This signal causes a special burglar alarm bell to be sounded and also lights a burglar alarm lamp.

A duration-of-impulse type of telemetering system is used to indicate both at the pumping station and at the water treatment plant the rate at which water is pumped. The telemetering transmitter is arranged to measure water flow by a venturi tube connection.

The transmitter sends impulses to a recorder at the pumping station and to the indicator at the water treatment plant over the carrier channel. The impulses are transmitted over the carrier channel only when the telemetering function is set up through the remotely located supervisory-control equipment.

The telemetering system operates on a 5-sec cycle. Each cycle of the transmitter is divided into an "on" and an "off" period. Zero reading is obtained on the receiver with minimum "on" period and full scale reading is obtained with maximum "on" period. The "on" period with zero water flow is approximately 0.5 sec. At a rate of water flow equal to full scale on the recorder and the indicator, the "on" period is approximately 4.5 sec.

When the telemetering function is selected by the operator at the water treatment plant, the telemetering transmitter is connected to the carrier transmitter at the pumping station and the water-flow indicator is connected to the carrier receiver at the water treatment plant. When the telemetering equipment is connected to the carrier equipment, the supervisory-control equipment is arranged so as not to respond to the carrier impulses originated by the telemetering transmitter.

Choice of Functions

The telemetered indication can be retained as long as desired. To release the indication and make the supervisory-control equipment available for other functions, the operator at the water treatment plant merely has to reset the equipment. The supervisory-control reset impulse is approximately 0.2 sec in duration. The circuits are arranged so that the reset impulse is not transmitted from the water treatment plant until the completion of a telemetering impulse from the pumping station which may be in progress. Since the minimum "off" period between telemetering impulses is 0.5 sec, the supervisory-control reset impulse can always be completed between telemetering impulses.

The supervisory-control receiver relay at the pumping station responds to all of the telemetering impulses. However, operation of the supervisory-control receiver relay with the telemetering transmitter contact being closed at the same time does not allow the supervisory-control equipment to reset.

When the reset impulse is received at the pumping station between telemetering impulses, the supervisory-control receiver relay is energized with the telemetering transmitter contact open. This condition allows the equipment to reset and the telemetering equipment is automatically disconnected from the carrier equipment at both the water treatment plant and the pumping station.

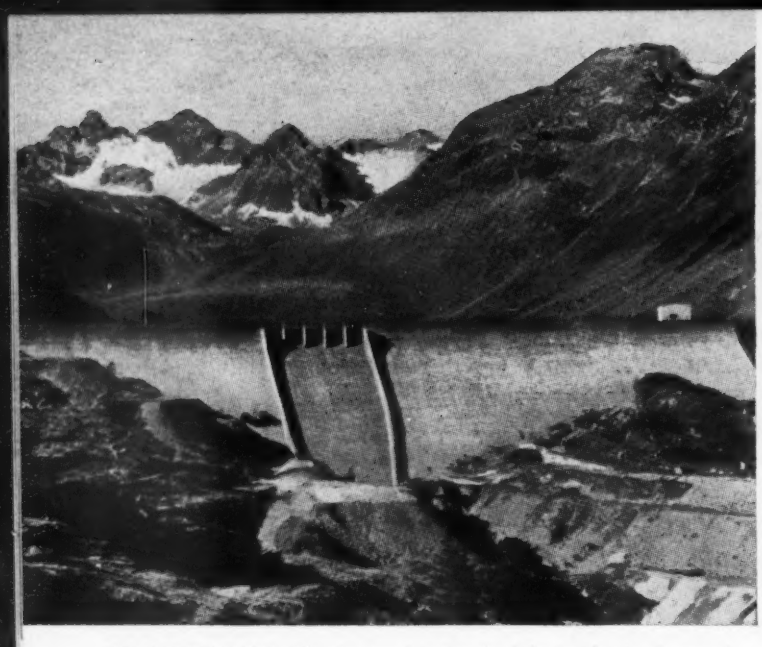
Communication and Versatility

Even though the pumping station is normally unattended, it was essential to provide communication between the water treatment plant and the pumping station. Communication is provided over the carrier channel through the supervisory-control equipment. The communication circuits remain established until the telephone handsets are restored to their cradles. When the telephone handsets are restored, the supervisory-control equipment is automatically unlocked and prepared for other functions.

This installation is an example of the possibilities of combined functions on a single power-line carrier channel. While only one selective telemetered indication was provided, it would have been possible to provide any number of selective indications on the same single-frequency carrier channel. Carrier relaying could also have been provided over the same single-frequency, power-line carrier channel.

There have been very few applications of power-line carrier equipment to lines rated less than 33 kv. The possibility of combined functions on carrier channels makes it economically sound to apply carrier equipment to lower-voltage lines.

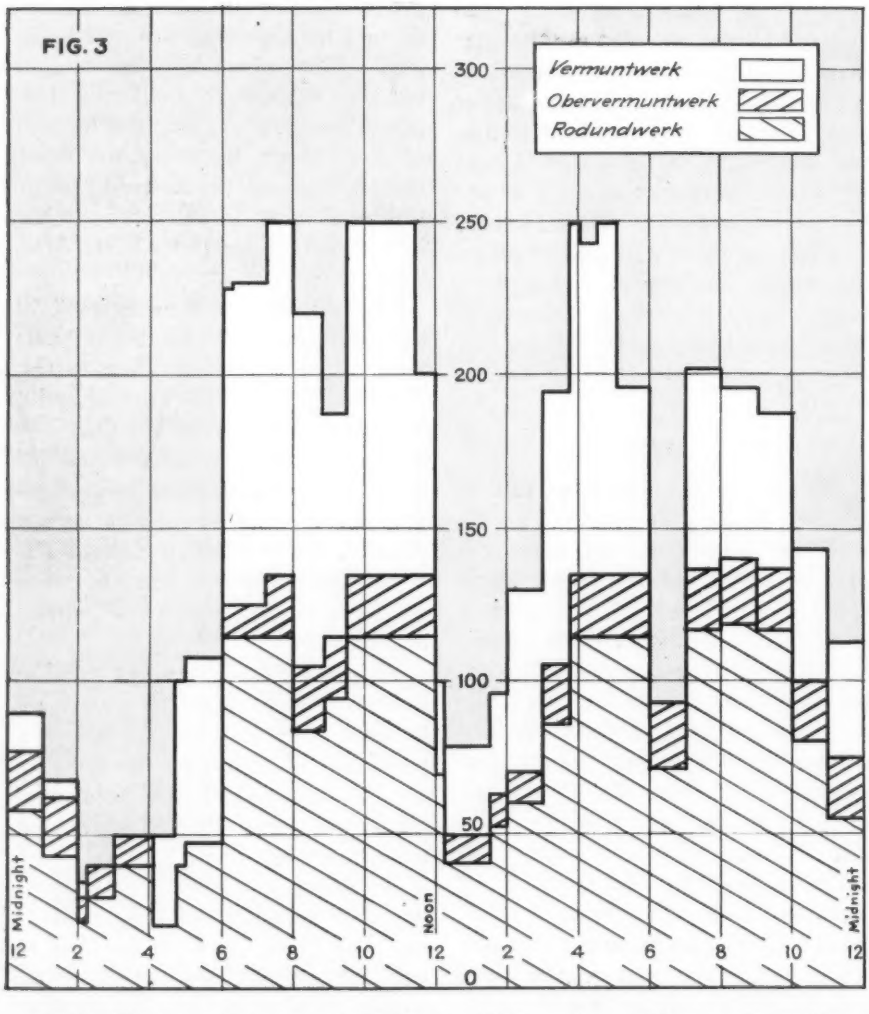
On future installations of power-line carrier equipment to lines rated less than 15 kv, it will be desirable to consider coupling means such as used on this installation, since the arrangement described should be satisfactory.



VERMUNT DAM with glaciers feeding its lake in the background

LUNERSEE with lake level lowered

Alpine Hydro Development



OPERATION for a typical Monday (July 31, 1944) pondage. Obervermunt, 22 Mw, 392,000 kwhr; Vermunt, 115 Mw, 1,382,700 kwhr; Rodund, 115 Mw, 1,943,000 kwhr

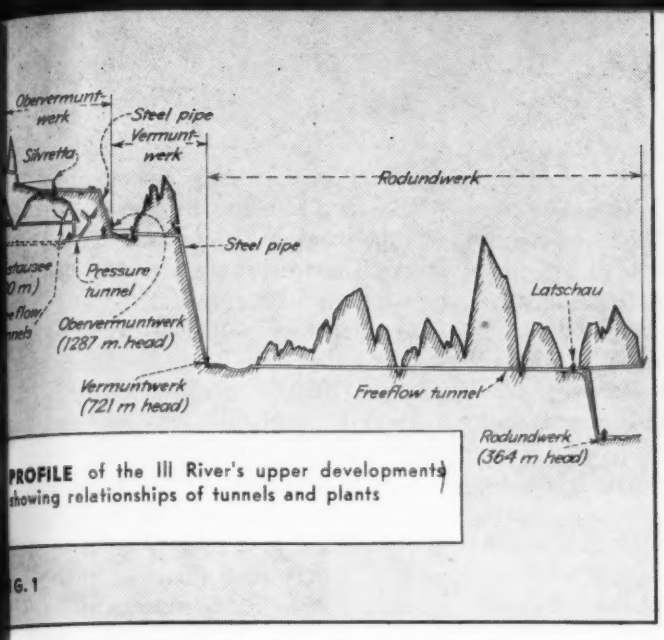
THOMAS C. McDERMOTT,
Division Engineer
Duquesne Light Co, Pittsburgh

ONE OF THE MANY hydroelectric developments in the Alps, the Ill River Project is the only one that plans the development of a complete river valley and utilizes heads of from 150 ft to 2,200 ft. It also includes an off-peak pump storage unit. The river empties into the Rhine some 30 miles south of Lake Constance.

The development has been through private capital and was started in 1925 with a capital stock of 80 million marks. Ownership is 47.5 percent German interests, 47.5 percent British-Swiss interests and 5 percent by the State of Voralberg. At the present time the investment is 80 million marks in stock and 47 million in bonds. This is about 50 percent of the ultimate cost, which is estimated at 225 million.

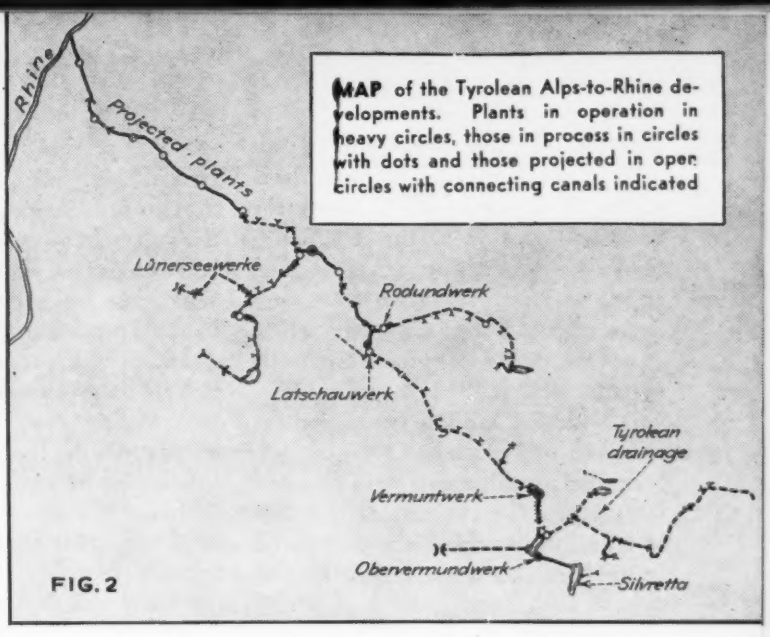
Ultimate plans for the complete development of the valley contemplate 750,000-kw capacity with an annual output of 800 million kwhr.

Three major power plants are now in operation, the Obervermuntwerk—with two machines of 15,000 kw each; the Vermuntwerk—with four at 21,000 and one at 35,000 kw; and the Rodundwerk with three at 47,000 and



PROFILE of the Ill River's upper developments showing relationships of tunnels and plants

FIG. 1



MAP of the Tyrolean Alps-to-Rhine developments. Plants in operation in heavy circles, those in process in circles with dots and those projected in open circles with connecting canals indicated

FIG. 2

Employs Pumped Storage

Complete development of River Ill involves utilization of off-peak pumped storage and heads up to 2,200 ft . . . Present capacity 290 Mw, ultimate 750 Mw

a fourth machine of the same size partially installed.

Drainage Area Plan

Largest of the reservoirs is the Silvretta, on the upper headwaters at elevation 2,000 m (6,500 ft) above sea level, which collects water from the glaciers. Water is carried from some of these glaciers to the reservoir by tunnels through the rock. Capacity of the reservoir is 20 million cu m (706 million cu ft) or 60 million kwhr. Work is not completed and the ultimate capacity will be 40 million cu m (1.4 billion cu ft) or 120 million kwhr.

From the Silvretta reservoir, water is conducted (Fig. 1) by two steel pipes along the river bed for about 3 km, where it drops at a 40-deg angle to the upper Obervermunt power plant, the head being about 287 m (940 ft). Water is discharged through the Power Plant into the Vermunt, or middle lake storage reservoir. Capacity of Vermunt is 5 million cu m at elevation 1,743 m (5,665 ft). Future plans provide for a power plant at the lower end of this same reservoir, the water for which will be conducted in from the drainage area to the east. Control of this drainage area supply will be through two reservoirs, Zeinistausee and Kopstausee. The Kopstausee will have a capacity of 90 million cu m at altitude 1,800 m (5,850 ft).

DURING THE WAR Colonel McDermott (2nd Regiment Europe, U. S. Military Government, AEF) was responsible for the power control and system rehabilitation successively in Normandy, Paris, Bremen and South Germany (Bavarian and Austrian Alps) areas. He is thoroughly conversant with the developments here described because he was on the spot for many months. These plants were not damaged; 47½ percent of the capital is British-Swiss.

Pressure Pipe Lines

From the Vermunt reservoir, two pressure pipe lines each 1.775 m (70 in.) in diameter, carry the water 2½ km by tunnel through the mountain. At the point where the tunnel emerges, twin pipes carry the water down the side of the mountain at a 45-deg angle to the power plant at Vermuntwerk. The head is about 721 m (2,365 ft).

After passing through the Vermuntwerk turbines, the water is carried by a pipe line, not under pressure, for 18 km down the valley to the Latschau, or lower lake storage. Capacity of this storage is 900,000 cu m or 700,000 kwhr. Additional taps add water from the various gullies at points along the way. The over-all drop in head from Latschau Reservoir to the turbines at Rodundwerk is 346 m (1,135 ft).

A chain of plants (Fig. 2) below the Vermunt plant will embrace developments at Rodund and Latschau with storage reservoir. At Burser there will be a junction with the Lunersee development; the lake (6,305-ft elevation) has a large natural storage of 40 million cu m and a yearly capacity of 290 million kwhr. It is planned to install pumping stations in order to hoist water to Lake Lune, using off-peak energy of the other stations.

From Burser station, it is planned to carry the pipe line on down the valley, extracting energy at six low head stations along the way, to the

junction with the upper Rhine River.

Vermunt dam raises the water level of the Ill River by 39 m above the river bottom, to a height of 1,743 m above sea level. The principal dam is 384 m long. The right wing connects with a 101-m side wall which closes the valley from the Kardatscha mountain ridge. This forms a reservoir with 5.4 million cu m content and 0.35 sq km surface.

Special arrangements were required for pouring the concrete of the dam as only five months of the year could be used for this work due to the altitude.

Cement was transported from Parthenen by a 4.7-km long aerial cable over an angle station heading through the Ill valley to Vermunt. The cableway overcame a total height of 715 m. With a carload of 350 kg and a velocity of the hauling cable of 2 m per sec the hourly capacity was 10 tons. On double cars, loads up to 1,000 kg were carried. The drive was located in the mountain power station.

Gravity Dam

Vermunt dam is a gravity wall with triangular section of tamped concrete. The inclination on the water side is 20:1, on the air side 1:0.68. It is made of individual blocks, 14 to 31 m wide, which are separated from each other by joints. These joints are made tight with copper sheets and reinforced concrete tightening bars placed in front of them. On the water side the dam is coated with a reinforced concrete plaster painted with inertol. Maintenance tunnels and shaft are provided in the dam. The Vermunt dam required 142,000 cu m concrete. The greatest height from foundation to crown is about 50 m with 38 m width of bottom. The width at the crown is 3.5 m.

Construction was started in the spring of 1928.

The water chamber is inserted at the end of the pressure tunnel before the latter leaves the mountain. It consists of a 38-m, perpendicularly rising shaft of 3-m diameter, an upper chamber, 100 m long with a section 4 by 5 m, and two chambers each 72 m long and 4 m in diameter at the bottom end of the rising shaft. The water chamber has a total content of 3,800 cu m. A 96-m inclined tunnel runs from the water chamber, with a gradient of 8 percent which is lined with riveted sheet tubes and is forked into the two pressure conduits leading into the valve chamber. The two conduits have an inner width of 1,775 mm. Where the water chamber enters the inclined tunnel, a rake is installed.

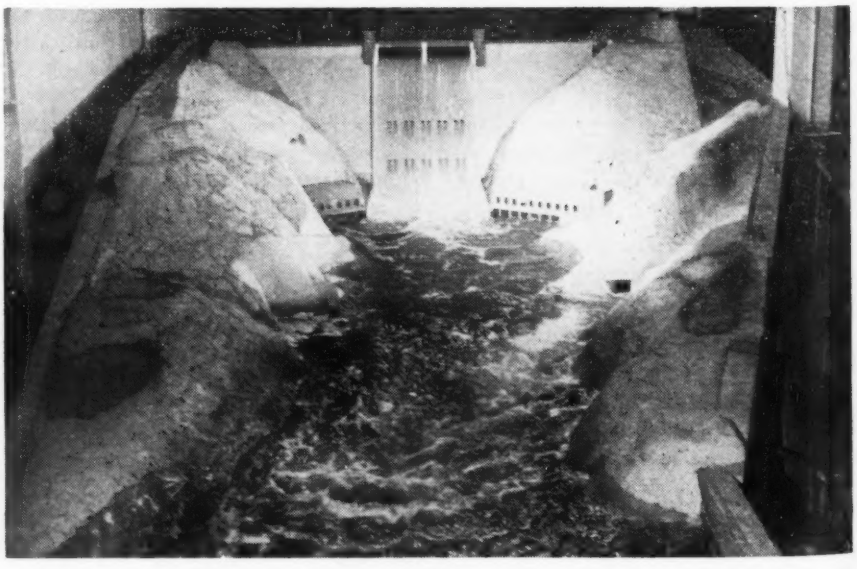
The pressure conduit (Fig. 1) had to have extraordinary dimensions for the existing drop and quantity of water utilized. The two pipe lines are subdivided in ten sections. Each are anchored in enormous concrete blocks of about 5,000 cu m which transmit the considerable forces originated by the weight of the pipe lines and the water pressure to the rock or the movaine soil. At the upper end of the individual sections expansions are inserted. The pipes rest on iron saddles on concrete or brick pipe sockets.

The pipe lines drop from the highest to the lowest arc foundation, over a length of 1,362 m through a difference of 669.90 m with steepest inclination at 85 percent. The inner width of the pipes decreases from top to bottom from 1,775 mm to 1,335 mm. The upper part of the pipes, down to elevation 1,265 m above sea level, is made of smooth hydrogen-gas welded pipes with wall thicknesses from 10 to 51 mm. In the lower part on a length of 573 m, so-called bandaged pipes are installed which are composed of core tubes from 25- to 36-mm wall thicknesses with seamless bandage rings hot shrunk on. The smooth pipes were joined with riveted sleeve joints and the bandaged pipes, with riveted links. The total weight of the two pipe lines is 5,100 tons.

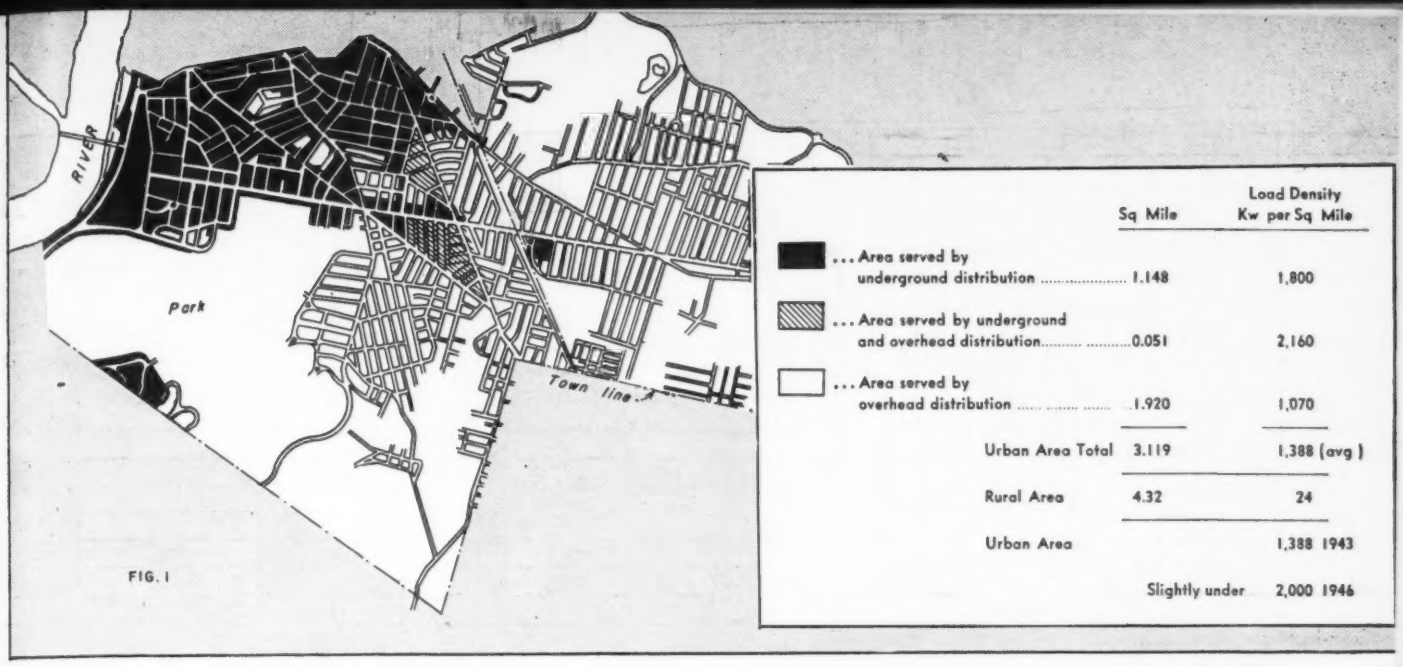
At first four machines were installed in the power house, the floor of which is 1028.60 m above sea level. Space for a fifth unit was provided and the unit is now installed.

Each unit consists of a single-nozzle, free-jet turbine of 500 rpm directly coupled to a three-phase generator with horizontal shaft supported by three bearings. The runners of the turbine are cast in one piece. The water enters as a 220-mm thick jet from the nozzle with a velocity of 115 m per sec. The turbines are equipped with double control. Brake nozzles are provided for quick shut-off. The capacity of the turbines is 31,800 hp for 4.03 cu m water per sec and a useful height of 688 m.

The generators have a capacity of 30,000 kva, and operate at 6 kv and 50 cps. Main and auxiliary exciters are directly coupled, overhanging. The total weight of a generator is 174 tons. The machines have natural cooling and suck the air through fresh-air channels from the open air. The waste air can either be blown into the open again or be used for heating the power house.



INDIA PLANS FOR THE FUTURE—This 1:80 scale model of Bhakra dam planned for Punjab Province, India, was recently completed by International Engineering Co, subsidiary of Morrison Knudson, Inc, Boise, Idaho. Final installed capacity is to be 400,000 kw. Initial installation will be three 80,000-kw units and two 3,000-kw service units in left bank powerhouse. Remaining installations will be made later on the right bank. It will cost $70,000,000


RIVER
Park
Town line
FIG. 1
Sq Mile
Load Density Kw per Sq Mile
... Area served by underground distribution 1.148 1,800
... Area served by underground and overhead distribution 0.051 2,160
... Area served by overhead distribution 1.920 1,070
Urban Area Total 3.119 1,388 (avg)
Rural Area 4.32 24
Urban Area 1,388 1943
Slightly under 2,000 1946

MAP OF DISTRIBUTION AREA selected for analysis of expansion costs. The load density in kw per sq mile for this area is also shown

Cost To Serve Heavier Distribution Load

Economic benefits of expanding loads on distribution system . . . Demand increased 50 and 100 percent, but more intensive use of plant investment encourages load building

J. W. BENNETT
Chief Engineer
Western Massachusetts Electric Co

IN 1944 AND 1945 the engineering department of the Western Massachusetts Electric Co, Springfield, made a study of the cost of serving 11,376 customers in a sample area in Springfield. Results of the study will be used to estimate the cost of supplying future demands of 1.5 and 2 times the 1944-1945 average demand.

All cost items from generating plant to customer's meter, inclusive, were covered, together with those items of capital investment and operating cost not directly traceable to any given class of business, and thus difficult to allocate to particular classes. Among these items were investment in general offices, storehouses, shops, laboratories and communication systems, salaries of general officers, legal expenses, printing, stationery, etc., prorated over the various items of investment directly assignable to a given class of business. A percentage was added to all directly allocated operating expenses to cover the above operating charges.

Integral cost figures have been avoided in this article because conditions in different areas vary so widely that dollar data would be of little value; instead, variations in costs are expressed in percentages.

Production Costs

High-voltage transmission from steam and hydro stations outside the immediate Springfield area provides a considerable part of the electrical energy utilized here. This is delivered to two bulk power substations. Within the city are also a small hydroelectric plant and a standby steam station. In determining investment in production facilities for this study, the two generating plants and bulk power substations, with short sections of 115-kv lines and 13.8-kv submarine cable between one substation and the steam plant, were considered as a production unit, whose total investment was allocated to production. Production operating and maintenance expenses consist of cost of energy purchased and delivered to the 115-kv side of the receiving substations, fuel cost at the steam plant, and operating and maintenance costs allocated to the foregoing production unit. In all cases these were based on the 1939-43 average.

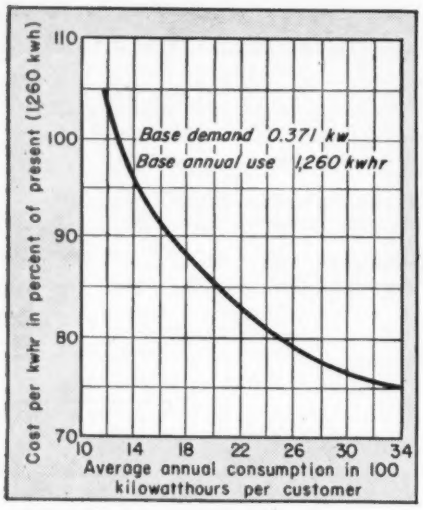
13-Kv Transmission Costs

The two generating plants and receiving substations are connected to each other and to the various distribution substations in Springfield, by a network of 13-kv underground cables. Investment in such transmission includes that in 13-kv tie cables and in conduit line allocated to such cables. This also includes investment in 13-kv equipment at distribution substations, with that part of land and buildings assigned to transmission. Here again, five-year operating and maintenance cost averages were allocated to this part of the system.

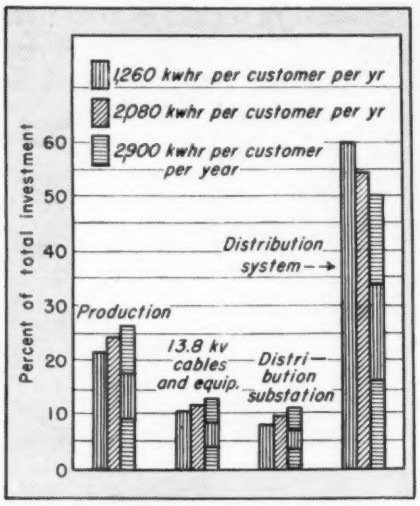
Distribution Substation Costs

Distribution substation investment includes the proportion assignable to this, and comprising transformers, all 4-kv equipment, buildings, land and miscellaneous equipment aside from 13-kv. The substation studied

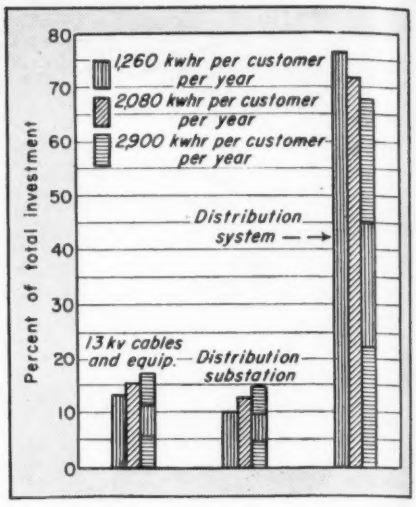
* From a paper before the Transmission and Distribution Committee, Edison Electric Institute, at Chicago.



REDUCTION of distribution service with increased domestic usage



PLANT INVESTMENT in production, 13-kv transmission, substation and distribution as related to basic year's energy consumption, and increases applied in subsequent years in residential usage



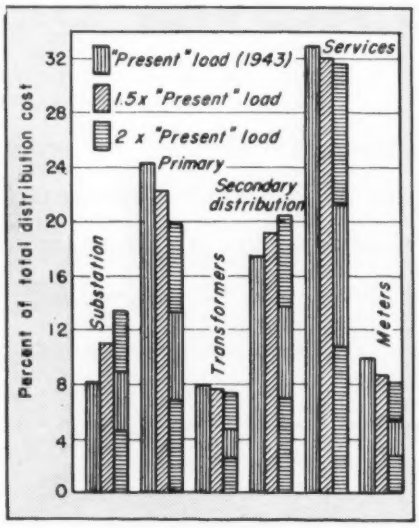
PERCENTAGE of total investment in 13-kv sub-transmission, substation and distribution system corresponding to the several blocks of residential energy consumption figured

has its 13-kv to 4-kv transformers outside the building which houses all switching and regulating apparatus. This substation building is a somewhat elaborate one-story and basement structure built in 1930 and has a firm capacity of 10,000 kva and an aggregate installed capacity of 15,750 kva comprising three 3-phase transformers.

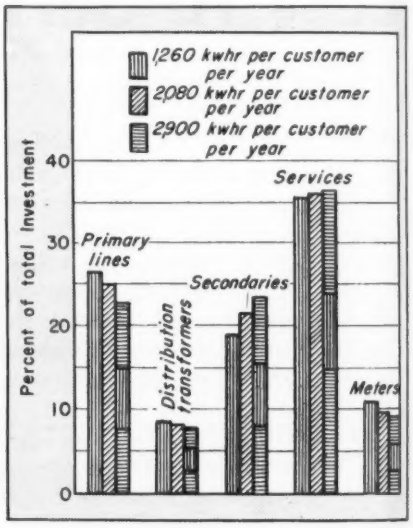
Distribution System Studied

The area studied is partly residential, with a small amount of commercial and industrial load. The industrial load could be separated readily from the rest and was not included in the study. A considerable portion of the area was served by underground circuits, differing from areas of similar load density found in many cities. Residences include some apartment houses, many two-family dwellings and also single houses. These last range from large mansions to rather modest four to six-room homes. In 1943 the average demand of customers in this area was 381 watts and average annual energy consumption in the area was 1,260 kwhr.

A detailed inventory of the distribution system in the area studied was made, and from this the total investment in the system and its principal parts determined. Operating and maintenance records for a five-year company average gave these costs. Miscellaneous costs like handling customers' accounts, meter reading, billing, collections, new business expense, maintenance of customers' installations, etc., were found by developing a system of units and allotting a certain number of these to each class of service.



PERCENTAGE of total distribution costs represented by distribution substation, primaries, transformers, secondaries, services and meters for the several blocks of load analyzed



PROPORTION of distribution service costs represented by primaries, distribution transformers, secondaries, services and meters for the three load magnitudes considered

The objective of this study was to find the cost per kilowatthour of supplying increased loads on the premises of existing customers. Hence it was necessary to estimate the additional investment to supply such increase. Estimates were made for average demands of 571 and 762 watts per customer (1.5 and 2 times the 1943 average). Corresponding annual energy consumptions were assumed as 2,080 and 2,900 kwhr. These were checked from a recent Edison Electric Institute report giving the relationship between watts demand and annual kilowatthours for residential service in the equation $y = 86 + 0.233\,x$, where y is the demand in watts and x the annual kilowatt hours. For a demand of 381 watts we get, for example,

$$x = \frac{381 - 86}{0{,}233} = 1{,}266 \text{ kwhr}$$

The actual average kwhr use in the area studied was 1,260 with an av-

erage demand of 381 watts, a substantially close agreement with the results from the formula.

Assumed Conditions

In estimating the investment in production facilities to handle the increased residential load, it was assumed that the cost per kilowatt of capacity would remain the same, i.e., the investment per kilowatt of peak load was assumed constant for all three load conditions. The carrying charges per kilowatthour decreased, however, with increasing customer demand because of the effect of improved load-factor. A similar assumption was made for the 13-kv transmission system. In the case of the distribution substation it was found that rearrangements would be needed, new feeder positions called for, etc. Estimates of the costs of such changes and additions were made for each of the assumed conditions enumerated above.

To determine distribution system investment required to supply increased load, the procedure was:

1. For the primary (4-kv) feeders, circuit layouts were made, with estimates of the cost of rearranging feeders and adding others.

2. To determine necessary changes in secondary mains and service, several typical areas were studied in detail; required changes determined, and costs estimated. These results were then applied to all areas of that type to find total investment that would be required.

3. Additional transformer vaults and manholes were located in the underground area based on secondary main layout.

Results of Study

When this study was made (1943 loads) the average demand of residential customers in the area analyzed was 381 watts and the average annual consumption 1,260 kwhr. This basic kilowatthour cost was taken as 100 percent. If the average demand was increased to 571 watts (150 percent up) and the annual consumption to 2,080 kwhr, the average cost per kilowatthour worked out as 84.6 percent of the previous average, and the increment cost of the additional 820 kwhr per year became 61 percent of the base.

Increasing the demand to 762 watts and the consumption to 2,900 kwhr resulted in an average cost per kilowatthour for 2,900 kwhr of 77 percent of the present. The average increment cost of the increase from 2,080 to 2,900 kwhr annually would be 58.5 percent of the present average cost.

The accompanying diagrams reveal a number of interesting points in regard to plant investment as related to proportions of various cost elements in facilities for serving customers having basic and increased demands and energy consumptions, and the benefits of utilizing such investment more intensively through load building.

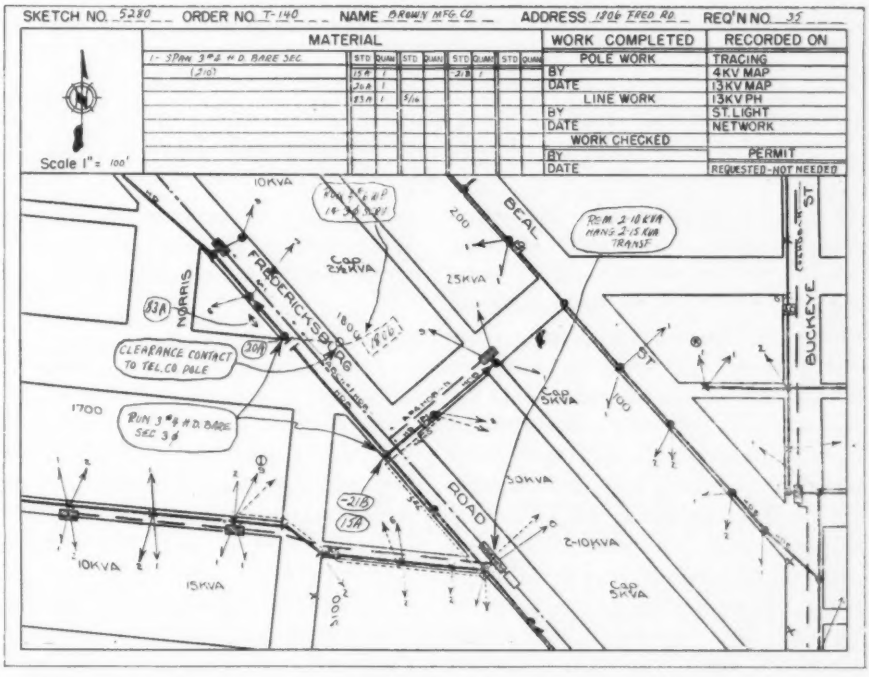
Work Order Drawings Made from Record Maps

C. K. JONES
Overhead Distribution Engineer
City Public Service Board
San Antonio, Tex.

WORK ORDER drawings for new services and line rebuilds are made directly on photostat copies of the office record maps in San Anntonio. Field inspection sketches and office drawings of work layouts are thus reduced to a minimum. Corrections are later made on the office records from the correction notes on the photostat copies.

The photostats serve also for the order and material information. This is provided for with a heading which is laid over the map section when the photostat is made. A drawing sheet with the spaces for material list and other records was mounted on a glass plate. The glass is laid over the section of map desired and the final sheet combines the heading and map.

After the field inspection, an office clerk completes the work list, and the foreman fills in the proper blanks on his copy. This simple procedure saves a large amount of drawing and detail inspection and assures that changes are fully related to the original layout. This in turn helps in the maintenance of the office record maps, insuring that they are up-to-date.

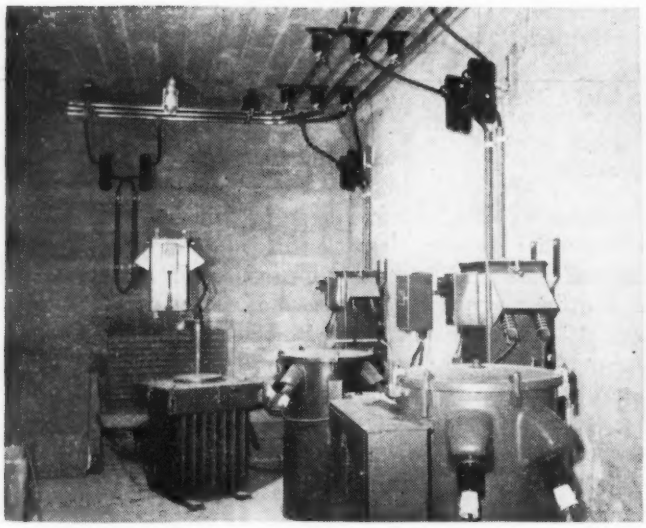


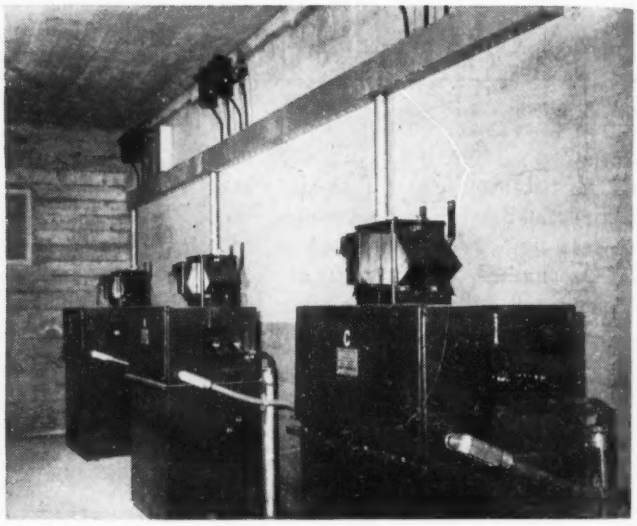
PHOTOSTAT COPY is made of the section to be field checked for rearrangement. Inspector's notes are placed on additional copies which serve for the line work layout also. (Pole numbers and some conductor sizes omitted here for simplicity—Editor)

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Enclosure Minimizes Bar Bus Hazards





ENCLOSED BUS prevents accidents. The above illustrations show clearly the safety advantages of completely enclosed, fully insulated bus as compared with the conventional bare tubular bus as installed in many transformer vaults. The view at the left shows a customer's vault with bare bus which was superseded at a later date by vaults with completely enclosed bus as shown at the right. Standard gutter and conduit wiring practice was adapted in making these enclosed bus installations in the transformer vault

Basic Principles of Fuel Clause Design

As ENUNCIATED by the Massachusets Department of Public Utilities, the objectives of any fuel clause should be to recover increased costs of energy due to fuels. Higher costs due to taxes, labor and materials are not a part of these and should be excluded. To prevent small variations from becoming applicable it should be possible to establish a neutral zone in the base price of fuel where a charge would not be created, if a company so desired. Any increase in plant efficiency should result in a lowered fuel adjustment, and some allowance made for changing fuel costs or hydro costs in power purchased. Basic principles follow:

A. Fuel clauses in filed rate schedules shall be designed to return to the electric company additional costs incurred on account of increased fuel prices above a base level, and conversely to give customers the benefit of decreased costs resulting from decreased prices of fuel below this level.

Definitions

(a) Ton of fuel—A quantity of fuel containing 29 million Btu, i.e., the Btu in a net ton of 2,000 lb, of coal of a quality of 14,500 Btu per pound, applicable to either coal or oil.

(b) Alongside cost—The cost per ton of fuel delivered at the location specified in the fuel clause, but not including any unloading, handling or similar charges.

(c) Cost of fuel—The cost of fuel for the purpose of a fuel clause for any month shall be the average alongside cost per ton of all fuel burned during that month, as ascertained by averaging such cost per ton of all fuel in storage on the first day of such month and received during it.

(d) Base cost of fuel—Shall be that specific alongside cost per ton of fuel at the specified location above or below which adjustments will be made in the price of electricity.

(e) Fuel adjustment—Shall be the amount of adjustment in the kilowatthour price for each unit of increased or decreased cost of fuel above or below the base cost of fuel. The unit to be used may be in steps as large as 10 cents per ton of fuel or as small as 1 cent per ton of fuel.

(f) Neutral zone—Shall be a range in the cost of fuel equally higher and lower than the base cost of fuel and within which the fuel clause is not applied. If the cost of fuel in any month is outside the neutral zone, the fuel clause

shall be applied (1) from the base cost, or (2) from the nearest boundary of the neutral zone.

B. The fuel clause contained in any rate schedule shall specify the base cost of fuel and the fuel adjustment. The application of any fuel clause shall be mandatory for decreases but may be optional for increases.

C. The base cost of fuel:

(1) Shall represent a specific alongside cost of fuel above or below which adjustments will be made in the rate.

(2) Shall be selected with regard to anticipated fuel price levels or on a basis of uniformity or precedent.

(3) May or may not include the use of a neutral zone.

D. The fuel adjustment:

(1) Shall be based primarily on the generating and delivery efficiency modified to reflect among other factors the proportion of purchased energy hydroelectric generation, etc., as well as whether or not a fuel clause is applied to all electricity sold.

(2) Shall be changed from time to time as changes in such efficiency may justify.

(3) Shall provide the same basis of adjustment whether the price of fuel is above or below the base cost of fuel.

• • •

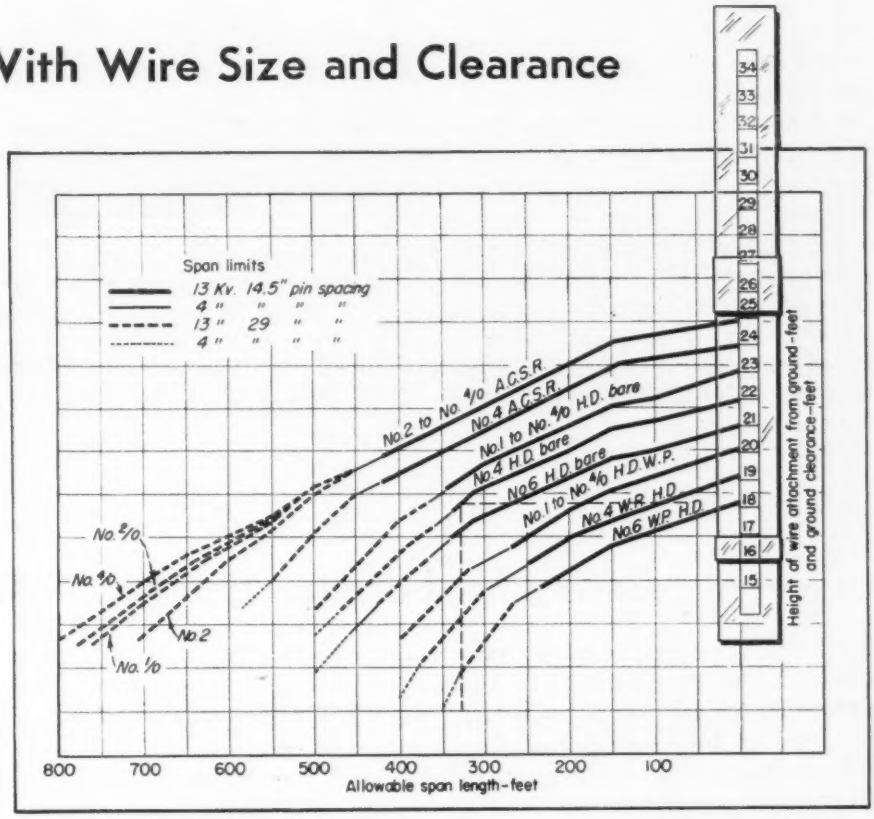
Chart Checks Span With Wire Size and Clearance

C. K. JONES
Overhead Distribution Engineer
City Public Service Board
San Antonio, Tex.

POLE HEIGHT and span length relationships are read directly for all conductors in use on our lines by use of the accompanying chart. The scale on right is a celluloid strip which can be moved up or down for the ground line clearances.

Example: To determine maximum span length with No. 4 H.D. bare wire along country road with lowest wire attachment at pole 22 ft above ground. Clearance at mid-span to be 18 feet.

Set movable vertical scale 22 ft opposite end of wire size curve. From the vertical scale 18-ft mark project horizontally to left to intersection of curve for the wire size (No. 4 H.D. Bare). From this point project down to span length scale, read 325 feet.



CURVES SHOW MAXIMUM SPAN LENGTH for given ground clearance and height of wire attachment at pole

• • •

Degassed Iron Considered for Vacuum Tube Parts

PURE degassed iron can effectively replace molybdenum and nickel in the construction of electrodes, getters, and other metallic parts of electron tubes, according to a report made available by the Office of Technical Service, U. S. Department of Commerce, Washington, D. C. The report, prepared by Major Wilhelm Jorgensen for the U. S. Naval Technical Mission to Japan, consists of five studies by leading Japanese experts in electronics.

Shortages of nickel and molybdenum during the war compelled Japanese engineers to investigate the use of iron for vacuum tube parts. They discovered that iron, when freed of occluded gases, possessed durability and electron emission characteristics comparable to those of molybdenum and nickel. However, the production process was more tedious and costly.

Raw material for the iron used in electron tubes was iron sand. The sand was reduced in an electric arc furnace and the iron metal drawn off. The metal was then melted in a high-frequency electric induction furnace and deoxidized with silicon and aluminum. As a result of this treatment the iron contained less than 0.02 percent of oxygen—the most harmful of

the occluded gases—and therefore became suitable for small receiving tubes.

However, large power tubes required iron with an even lower oxygen content. To obtain such purity, the iron after deoxidation with silicon and aluminum was heated in a stream of hydrogen at 1,100 C for two hours. The final oxygen content of the power tubes was less than 0.004 percent.

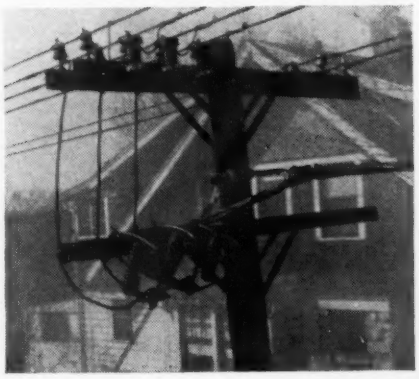
• • •

Aerial Cable Adds Capacity

FRED P. GILPIN
Electric Distribution Dept
Kansas City Power & Light Co
Kansas City, Mo.

ADDITIONAL feeder capacity was provided, without the necessity of rebuilding the existing pole line, in a residential section of Kansas City, by the use of aerial cable on the same poles. A minimum clearance of 48 in. was maintained to the telephone cables below.

An accompanying illustration also shows the method of cable termination and connection to the open wire circuit. The cable No. 3/0 with 10/64-in. rubber compound insulation and a 5/64-in. neoprene jacket for operation at 2,400/4,160 volts.



AERIAL cable conductors are simply spread out to terminate in disconnects for this tie to an open-wire circuit

THROUGH the trees instead of over the top on higher poles. Open-wire line is above and telephone cables below in this thick growth

• • •

Caring for Leather Used in Pole Climbing

INSPECTION, maintenance and storage of lineman's leather items such as body belts, tool holsters, safety straps, climber foot and leg straps and pads, are covered in instructions arranged as a guide for electric utilities and more particularly for safety of linemen. The following procedure is an adaptation from a field manual, "Use and Care of Pole Climbing Equipment," prepared recently by the Accident Prevention Committee of Edison Electric Institute.

AN INSPECTION is recommended before starting work each day by the foreman and the lineman using the climbing equipment. They should examine:

Leather or fabric for cuts, cracks, tears, enlarged eye holes in straps or wear that might affect its strength, and for hard and dry leather.

Stitches for breaks, ragged strands and loose or rotted threads.

Hardware for breaks, cracks, fractures, loose anchorage or wear that might affect the strength of the equipment, improper action of keeper on snap hook, and length, width, thickness and sharpness of gaffs.

REPAIR OR REPLACE the defective part as soon as it is possible to do so. The equipment will serve its purpose longer and more faithfully as a result.

CLEAN AND DRESS the leather used for climbing every third month to keep it soft and pliable. Do this more often if equipment is subjected to paint stains or excessive moisture from wet weather or perspiration.

To clean leather:

1. Wipe off surface dirt with a sponge dampened with water only.
2. With a clean moist sponge and a neutral soap, work up a thick creamy lather to remove imbedded dirt and perspiration.
3. Wipe off with a cloth.
4. Work up a lather again with saddle soap, and rub it well into all parts of the belt or strap.
5. Wipe off with a cloth.

To dress leather:

1. While the leather is still damp, apply a leather dressing, working it lightly into the leather with the hands. Always clean any leather before dressing it.
2. Let the belt or strap dry in a shady place for about 24 hours.
3. Rub vigorously with a soft cloth to remove any excess oil.

Use only a limited amount of leather dressing prepared from an animal or vegetable source. Never use any type of mineral oil or grease. Never store or dry wet leather near source of heat such as an open fire, stoves, hot steam pipes or radiators. Artificial heat will cook or burn leather making it hard, brittle and weak.

STORE body belts and safety straps away from sharp-edged tools.

How to Determine Heat Recovery With Boiler Continuous Blowdown System

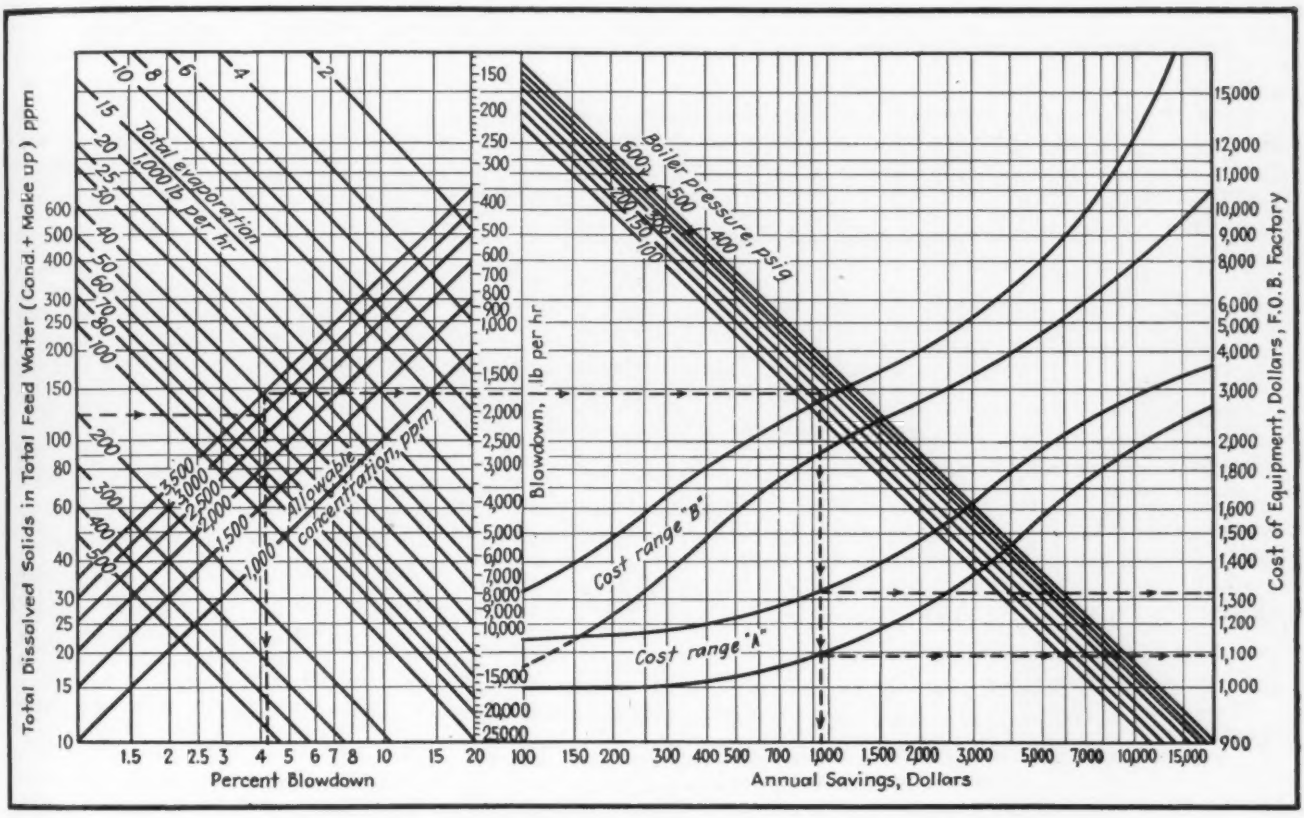

Total Dissolved Solids in Total Feed Water (Cond. + Make up) ppm
Total evaporation 1,000 lb per hr
Allowable concentration, ppm
Blowdown, lb per hr
Boiler pressure, psig
Cost range "B"
Cost range "A"
Cost of Equipment, Dollars, F.O.B. Factory
Percent Blowdown
Annual Savings, Dollars

CHART GIVES PERCENT BLOWDOWN for permissible concentration of total solids in boiler water, also expected annual savings and an estimate of cost for equipment

M. C. McKEOWN
Cochrane Corp
Philadelphia, Pa.

IN A CONTINUOUS blowdown system employing the "flash" principle, heat is recovered in two stages: (1) By the utilization of steam flashed from the blowdown and (2) by directing the hot waste water remaining after flash through a heat exchanger.

Referring to the chart, cost values in right-hand abscissa are estimates for continuous blowdown equipment such as manufactured by Cochrane Corp.

The left-hand abscissa is the value of Total Dissolved Solids (TDS) in the feedwater to the boiler including makeup and all condensate returns. Its actual value is found by multiplying the TDS in the raw makeup by the percent of makeup.

Example for Chart

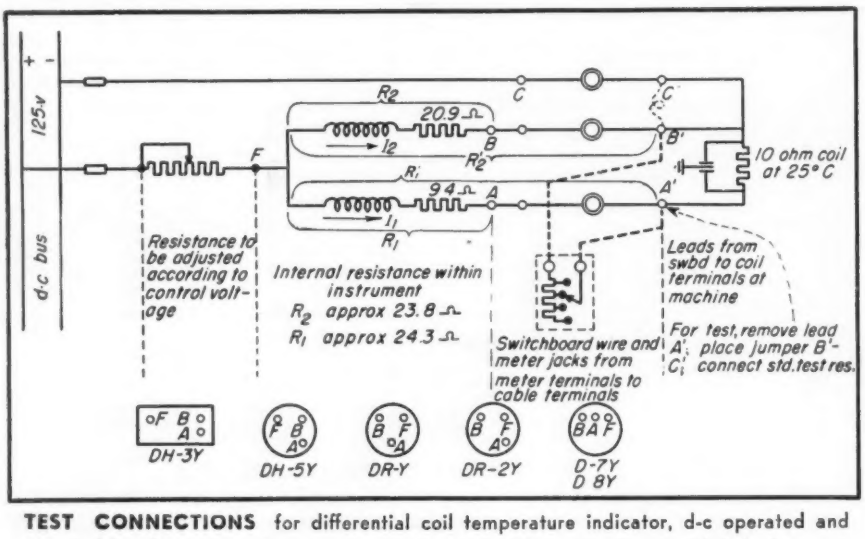
TDS = 125 ppm
Allowable boiler concentration = 3,000 ppm
Boiler pressure = 200 psi
Total evaporation = 40,000 lb/hr

Enter chart at the left at 125 ppm and draw horizontal line to the 3,000 ppm allowable concentration line. Through this point draw a vertical line to the bottom of the chart and read the percent of blowdown (4.2 percent). Now extend the vertical line, (if necessary) until it intersects the proper total evaporation line (40,000 lb/hr) and draw a horizontal line to the right from this point of intersection to the proper boiler pressure (200 psi), reading the total blowdown (1,754 lb/hr) where the line intersects the blowdown column. From the intersection of this line with the proper boiler pressure line, drop a vertical line to the bottom of the chart and read the approximate annual savings ($950) for operation 24 hr per day, 300 days per year with 75 percent boiler efficiency and 14,000 Btu per pound coal at $5 per ton on the grates. (For values other than these multiply the annual savings by the appropriate factor as for instance for 12-hr operation multiply annual savings by one-half).

Where the vertical line intersects the limits of Cost Range "A" draw two horizontal lines to the right-hand edge of the chart and read the approximate cost of equipment ($1,090 to $1,320) for a one-flash tank system. For total evaporations in excess of those covered by the chart, divide the total evaporation by 10 and proceed as before, multiplying the determined blowdown and annual savings values by 10 for final result. When this procedure is followed, Cost Range "B" is to be used directly without applying any factor.

How to Maintain Temperature Indicators For Generators and Large Transformers

II*—DIFFERENTIAL COIL INSTRUMENTS



TEST CONNECTIONS for differential coil temperature indicator, d-c operated and actuated by change in resistance of a 10-ohm embedded coil. Terminal labels shown at bottom of the connection diagram are for eight forms of indicators

W. F. DUNKLE
Supervisor of Electric Tests
Pennsylvania Power & Light Co
Hazleton, Pa.

A TESTING and maintenance procedure for resistance type temperature indicator and accessories manufactured by General Electric Co.

Instruments torque varies inversely as the resistances of the two resistance paths through which the current must flow, i.e., (1) from F via B' to C and (2) from F via A' to C in the schematic diagram. Current through the No. 1 path makes the instrument read up the scale, while that through the No. 2 path makes it read down the scale toward zero. The net result is the difference of the torque and hence the nomenclature "differential coil instruments." The effect of contact resistance in the (2) circuit is obvious.

1. Resistance Tests on Meter. With the control switch off, measure accurately the resistance of the instrument from stud F to stud A or R_1 and from stud F to B or R_2. These values should be recorded on the instrument record card. Measure the resistance from F to the single lead side of the detector coil side of the transfer switch and call that resistance R'_1. Measure resistance from F to double lead side of the transfer switch and call that resistance R'_2.

Under no condition should $R'_1 - R_1$ or $R'_2 - R_2$ be greater than 0.0385 ohm which is the equivalent of one (1) degree.

Calculate—Balanced Resistance Temperature from the formula

$$T = \frac{R_o - (R_1 + 10)}{0.0385} + 25 \text{ C}$$

The General Electric Co instrument "balance point" is the position at which the circuits of the detector and standard are of equal resistance. The off-voltage or drift point may be different from the balance point.

2. Routine Full Scale Instrument Test on Instruments Using 10-Ohm Coils:

(a) Remove the (A') lead from the transfer switch.

(b) Substitute the standard test resistor in place of a detector coil, connect it between points marked A' and B' with test leads of less than 0.07-ohm resistance.

(c) Connect the shortest possible jumper between points marked B' and C' on the plug receptacle.

(d) Place the voltage adjusting switch on point corresponding to the d-c station control voltage—position.

(e) Rotate the control knob of the standard resistor to 9.81, 10.58, 11.35, 12.12, 12.89, and 13.66 ohms, etc., thus checking the instrument for scale error at 20, 40, 60, 80, 100, and 120 C.

(f) When the instrument tests low at low scale values and high at high scale values, increase the series resistance in the positive voltage leg to the instrument. This can be done readily by changing the connections on the tapped series resistor.

(g) If the correct calibration cannot be attained in the field, remove and send the instrument to the laboratory for rescaling. Notify the Owner Department of your proposed action for their approval and the request that a work order accompany the instrument.

(h) Record "As Left" accuracy and balanced position of pointer on the instrument record card.

3. Adjustments to Instrument

(a) Record the "As Found" accuracy and balanced position of pointer.

(b) If the instrument's accuracy at the balance "off-voltage" resistance point differs when tested by the foregoing methods, it indicates electrostatic induction, unbalanced resistance between the instrument and its exploring coil, defective insulation or protective film gaps, incorrect resistors or wiring. Trace the wiring, determine and correct the causes. Make sure contact resistance is eliminated at all junctions.

(c) When tests show that the meter reads in error by an equal number degrees at all points on the scale, shift the deenergized position of the pointer. Make sure you have adequate facilities for removing the pointer, i.e., a pointer puller. To retain the same deenergized position of pointer, the resistor in series with standard circuit must then be adjusted. Under no circumstance are you to attempt pulling pointer off shaft with pliers.

4. Routine Single Point Test at Operating Temperature. Measure accurately the detector coil resistance plus that of the leads to and from the coil; subtract lead resistance (measured from B to C). From the remainder R, compute the corresponding temperature of the exploring coil by formula:

$$\text{Temp} = \frac{(R - 10 \text{ ohms})}{0.0385} + 25 \text{ C}$$

$$= 25.95\,R - 234.5$$

If operating above 80 C, the instrument reading should correspond within 3 C with the calculated single point test at operating temperature and with the standard tapped resistor test.

* This series began in ELECTRICAL WORLD, July 19, 1947, page 106.

BREAKERS

SEALED BUSHINGS

FOR REDUCED MAINTENANCE

Twelve-years' experience with over 80,000 moderate-voltage sealed bushings gave General Electric the background for developing these pressure-tight bushings for high voltages. Complete protection against contamination of the internal insulation structure means maintenance costs are reduced.

- **The initial high dielectric strength of the liquid and solid insulation is maintained by the completely sealed construction which prevents the entrance of air or moisture. Since the expansion chamber is made of metal, the insulating liquid is not exposed to the deteriorating effects of sunlight.**
- **The initial power factor of the bushing is low, and remains low in service, giving assurance that the bushing is in good condition and free from deterioration.**
- **The magnetic liquid-level gage provides an accurate indication of the oil level in the bushing. Even if the glass enclosing the dial is broken there is no danger from leaks or from moisture entering.**
- **When excess potentials, either 60 cycles or impulse, are applied, the bushing will repeatedly flash over externally rather than puncture or shatter.**
- **Bushings in storage are always ready for immediate installation.**

The FK-439 breaker also has a new lightweight interrupter that assures faster circuit interruption. High-speed reclosing is accomplished by the smooth positive action of the pneumatic mechanism. In addition to facilitating maintenance by increasing the accessibility of operating parts, redesign has also decreased the tank dimensions and over-all unit weight. Call or write your G-E sales representative for bulletin GEA-4407 which tells the complete story of the "439" breaker. *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

Standard 138-kv Completely Sealed Bushing

GENERAL ELECTRIC

859-6

No Job for Quiz Kids

LETTER-SIZED binders keep Nepsco Services, Inc, at Augusta, Me., up-to-date on construction jobs and plant components of Central Maine Power, Public Service Co of New Hampshire, Central Vermont Public Service Corp and other systems. These data books are classified as (1) "Important Data;" (2) "Job Books," and (3) "Construction Book Summaries." They cover developments of many years which cannot be left to memories of individuals or as conveniently preserved in scattered files.

Material varies considerably in content on account of differences in plant design and layout of system facilities; a few typical examples from each type of book indicate the scope of the information assembled and maintained in the office of the chief engineer, Frank H. Mason.

Important Data

List of manufacturers' drawings, cost estimates, drainage areas of hydro development, generator capacities, number of units and operating head, annual kwhr outputs, field costs, average and maximum loads, plans and elevations of plant, storage capacity for water, type of dam, discharge capacity, dates, steps completed, principal apparatus (generators, governors, switchboard, circuit breakers, gate hoists), structural steel, materials in building, towers, outdoor substation facilities, cable (sizes, type, capacity in amp, insulation, voltage and conductor price per ft), transformers, lightning arresters, bus supports and tubing. Also resumés of specifications; location plans; one-line electrical diagrams; water used in cfs by hydro units at various heads and outputs; gate discharge at various heights; important orders placed on job, with numbers, dates, manufacturers' names, brief descriptions and cost information; analyses of work orders and costs; river duration curves; and lists of construction drawings.

Transmission data include relay settings, automatic control equipment; transformer performance, efficiency curves, temperature rises and insulation tests; manufacturers' drawings; engineering department drawings; one-line electrical diagrams; voltages for power-factor variations; plans and elevations of substations; and photostats of transformer name plates.

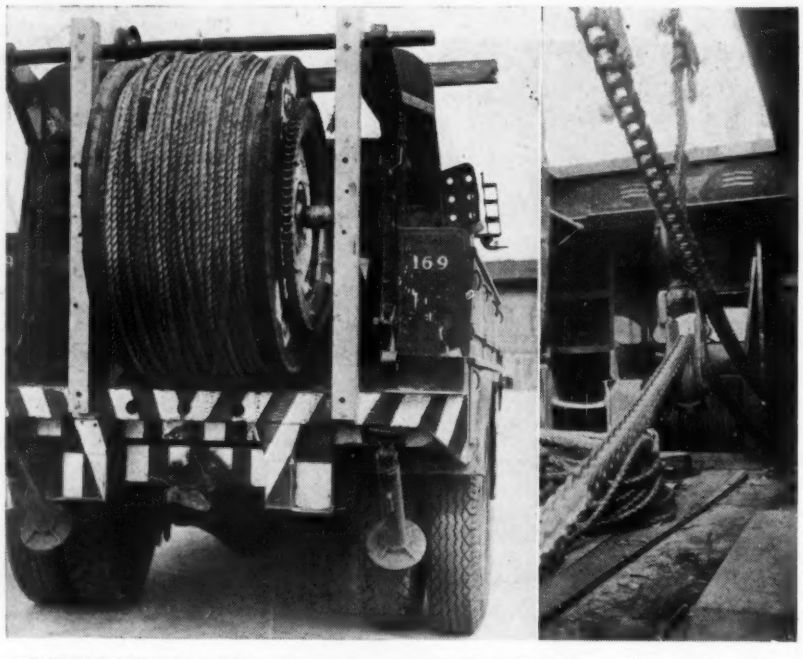
Job Book

Combustion tests, work orders, costs, water-sample tests, boiler-inspection report; log sheet; report on corrosion prevention; weights of rotors and stators of generating units, with shipping dimensions; cable orders and data; list of thermometers, scales, ranges and locations; list of principal gages; list of valves (locations, psi, materials, body types, makers) painting schedules; job progress steps; cable deliveries; shipment schedules; contract data and specifications; description of development.

For a hydro plant, general description; design drawings; output data; maps; plans and elevations; inventory schedules; tail-water readings; log sluices; one-line electrical diagram; conversion charts; generator and wheel efficiencies; contract data; pond capacities at various elevations; spillway and gate discharges, benchmark data; important orders; tests of concrete; river elevation data; flood discharge data; deeds; map of construction plant (if required); future work needed; material removed.

Construction Book

Location plan; general plan and elevation; substation, power house and other photographs; plant sec-



TRUCK-MOUNTED REEL driven from winch through chain and sprocket. Idler pulley (right) takes up slack in roller chain, keeps it from slipping from sprockets

Wire Pulling Rig Added to Truck Body

L. COOK
Line Foreman
New Orleans Public Service

STANDARD SPROCKET gears obtained from a local machine shop, plus stock wire reels and other parts, were used to build the wire pulling attachment illustrated. A small sprocket is mounted on the shaft of the truck winch. A large sprocket is bolted to the reel, with nuts easily removable. A spare reel is provided; the sprocket may be put on either in a short time.

REVERE detects *VIBRATION* at a distance

DO you know that vibration can be present in the tubes of a condenser, though not perceptible in the shell? Putting the palm of your hand on a condenser is not a good test for destructive vibration. The best test is one carried out in the Revere Research Laboratory in Rome, N. Y., which makes a microscopic examination of the metal as a part of its work in determining causes of tube failure. If vibration contributed to short life, this examination will show it. Vibration accelerates corrosion in several ways. The alternating stresses in time produce cracks across the grain of the metal, weakening it and giving corrosive fluids more points to attack. Vibration also breaks or disrupts or disturbs the thin film on the surface of the metal that protects it and helps reduce the rate of corrosive attack. Of course vibration is but one of a number of factors influencing the service life of condenser tubes, and so when tube life is questioned we always suggest that samples from failed tubes be sent to us. We may be able to help you, as we have others, with suggestions that should materially extend the period between re-tubings.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

tions; river duration curves; performance curves of turbines; logs; waterways discharges; lists of important orders, principal equipment, spare parts; engineering drawings; manufacturers' prints; cost summaries.

. . .

Watt and Var Solution for Unbalanced Loads . . . III*

E. C. GOODALE
Bonneville Power Administration
Portland, Ore.

USE of watts and vars instead of volts, amperes and power factor in determining the effects of unequal load distribution among units of a transformer bank greatly simplifies the problem, and also makes possible readily determining the regulation for unbalanced load conditions. The watt and var basis simplifies the determination of load distribution among the units of a transformer bank when it is subjected to unbalanced secondary loading. The equivalent watts and vars, determined in Tables I, II, and III, may be substituted in equations (3) and (4), preceding, to determine the effects of the unbalance on the transformer secondary voltages.

Load Designation

In Tables I, II, and III the numbers 12, 23, etc., refer to the transformer in question. The second column, W or V, denotes the actual watt or var load on this transformer and each is the equivalent of the expression to the right of it, tabulated under "Equivalent W or V" and expressed in terms of all of the watt and var loads affecting it. The equivalent values of W and V, thus found, are substituted in equations (3) and (4) to determine the values of ϕ and RCF for the transformers designated in the first column.

W_{12} and V_{12} designate the watt and var loads that are connected directly to the same conductors to which transformer No. 12 is connected. The notation is similar for the other conductors. W_1 and V_1 designate the watt and var loads that are connected line-to-neutral to the same conductor as transformer No. 1.

It is assumed that all transformers are connected to similar primary and secondary taps, also that the primary voltages are reasonably well balanced. It is assumed also that the phase sequence is 1-2-3. That is, the voltage E_{23} lags voltage E_{12} by 120 deg., E_{31} lags E_{23} by 120 deg. and E_{12} lags E_{31} by 120 deg., approximately.

The values of W and V, determined as indicated above, are the actual watt and var loads to which the transformer secondary windings are subjected and may be used in determining the permissible loading for each individual transformer. Primary excitation watts and vars are not included nor are the I^2R watt losses and I^2X var losses. (If V is not known it may be found equal to $W \tan \theta$, where $\cos \theta$ = power factor.)

Whereas watt-loads and var-loads are mentioned above, the loads may also be expressed in terms of kilowatts and kilovars, or megawatts and megavars. The transformer bank rating, M, should be expressed

TABLE I—Evaluation for unbalanced loads in open-delta transformers with closed-delta loads

Values to be substituted for W and V in Eq. (3) and (4) are: Transformer No.	W or V	Equivalent W or V	
12	W	$W_{12} - 0.866\ V_{31} + 0.5 W_{31}$	(5)
	V	$V_{12} + 0.866\ W_{31} + 0.5\ V_{31}$	(6)
32	W	$W_{32} + 0.866\ V_{31} + 0.5 W_{31}$	(7)
	V	$V_{32} - 0.866\ W_{31} + 0.5\ V_{31}$	(8)

$\%R$, $\%X$, and M in this case are chosen with reference to the rating of the transformer across the phase in question. The transformers do not have to be alike.

TABLE II—Evaluation for unbalanced loads in wye-delta or delta-delta transformers with unbalanced delta loads

Values to be substituted in Eq. (3) and (4) for W and V are: Transformer No.	W or V	Equivalent W or V	
12	W	$2/3\ W_{12} + 1/6\ (W_{23} + W_{31}) + 0.2885\ (V_{23} - V_{31})$	(9)
	V	$2/3\ V_{12} + 1/6\ (V_{23} + V_{31}) + 0.2885\ (W_{31} - W_{23})$	(10)
23	W	$2/3\ W_{23} + 1/6\ (W_{31} + W_{12}) + 0.2885\ (V_{31} - V_{12})$	(11)
	V	$2/3\ V_{23} + 1/6\ (V_{31} + V_{12}) + 0.2885\ (W_{12} - W_{31})$	(12)
31	W	$2/3\ W_{31} + 1/6\ (W_{12} + W_{23}) + 0.2885\ (V_{12} - V_{23})$	(13)
	V	$2/3\ V_{31} + 1/6\ (V_{12} + V_{23}) + 0.2885\ (W_{23} - W_{12})$	(14)

The value of M is the megavoltampere rating of one transformer. All are assumed to be alike in capacity and $\%R$ and $\%X$. If dissimilar, the numerical multipliers in the above expressions will be changed.

TABLE III—Evaluation for unbalanced loads in delta-wye or wye-wye connected transformers with wye or delta connected loads

Values of W and V to be substituted in Eq. (3) and (4) are: Transformer No.	W or V	Equivalent W or V	
1	W	$W_1 + 0.5(W_{12} + W_{31}) + 0.2885\ (V_{12} - V_{31})$	(15)
	V	$V_1 + 0.5(V_{12} + V_{31}) + 0.2885\ (W_{31} - W_{12})$	(16)
2	W	$W_2 + 0.5(W_{23} + W_{12}) + 0.2885\ (V_{23} - V_{12})$	(17)
	V	$V_2 + 0.5(V_{23} + V_{12}) + 0.2885\ (W_{12} - W_{23})$	(18)
3	W	$W_3 + 0.5(W_{31} + W_{23}) + 0.2885\ (V_{31} - V_{23})$	(19)
	V	$V_3 + 0.5(V_{31} + V_{23}) + 0.2885\ (W_{23} - W_{31})$	(20)

The value to be used for M is the megavoltampere rating of the transformer on the phase under calculation. Values for $\%R$ and $\%X$ apply to the same transformer. In this case the above substitutions in Eq. (3) and (4) will give correct results whether the transformers are all alike in capacity and $\%R$ and $\%X$ or each one is different.

An interesting feature of Table III is that these same equations, (15) to (20) inclusive, may be used to determine the watt and var loading of line conductors 1, 2, and 3 for a wye and delta loaded, or plain delta loaded system, assuming a value for line-to-neutral volts. The line currents are the root mean-square of W and V, derived by line-to-neutral volts. The transformer connections do not matter in this case.

* Concluding a three-article series which began in ELECTRICAL WORLD, July 5, 1947, page 108, on the use of watts and vars to simplify power system problems. All equations are numbered in sequence throughout the series of articles.

[These articles are in conflict with the prevailing standard for sign of reactive power but in conformity with a pending recommendation for reversal.—Editors]

THREE MAJOR APPLICATIONS

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- **TROUBLE ISOLATION**
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Plus:
COMPLETE CONSTANT CONTROL

Automatic air break switches open a broad field for improvement of customer service at relatively low cost. For industrial or commercial customers, who can't afford power interruptions, a load may be transferred instantaneously or, after a predetermined time delay, from a preferred to an emergency source, and then back to the preferred source upon restoration of potential.

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JACKSON, MICHIGAN
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CLEVELAND, OHIO
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PITTSBURGH, PENNSYLVANIA
CHARLESTON, SOUTH CAROLINA
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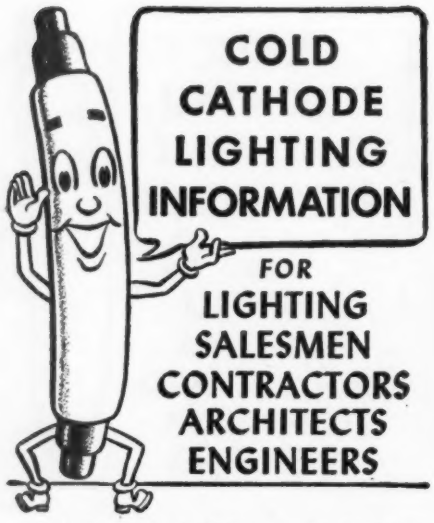
MEMPHIS, TENNESSEE
DALLAS, TEXAS
HOUSTON, TEXAS
LUBBOCK, TEXAS
SALT LAKE CITY, UTAH
RICHMOND, VIRGINIA
SEATTLE, WASHINGTON
MILWAUKEE, WISCONSIN



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correspondingly in terms of kilovolt-amperes or megavolt-amperes.

Since these equations are independent of the size of the transformers in question, they are applicable also to the solution for the effective burdens on potential transformers or auxiliary potential transformers.

• • •

Reflector Antenna Solves "Skip" Problem

SEPARATE THREE-ELEMENT beam receiving antenna strengthens local 39.86-mc FM signals and at same time eliminates "skip" on foreign utility stations operating in the 30-mc band

W. L. CAMPBELL
Northwestern Electric Co
Portland, Ore.

INTERFERENCE, or "skip," from Eastern utility FM stations operating in the 30-mc band became so troublesome to Northwestern Electric Co of Portland, Ore., that something had to be done. As high as 60 Eastern stations a day could be logged. All foreign signals were coming in from Eastern stations (none from up and down the West Coast) and this gave a lead on which to work.

It was decided to try receiving the Eastern signals on a beam antenna and feeding them against themselves coming in on the main antenna. Theoretically, if properly done, this should cancel out the foreign signals. To do this, it was necessary to install a parasitic element of the reflector type. This meant arrangement of an additional element so as to receive its power by induction or radiation from the antenna and reradiate it in proper phase relation to achieve the desired effect.

The parisitic element is called a director when it reinforces radiation on a line pointing to it from the antenna, and a reflector when the reverse is the case. Whether the parisitic element is a director or reflector depends upon its tuning, which is adjusted by changing its length, and particularly when the element is self-resonant, upon the spacing between it and the antenna.

This was tried with fair success and most of the Eastern interference, including radiation by local diathermy equipment, was eliminated. In doing this, however, it was found that, due to reflections of signals from the company's own cars, there were locations in which car signals were themselves eliminated. In making these tests, a panoramic adapter was used. This permitted seeing signals coming in and thus gave a clearer idea of what had to be contended with. It was found that signals as far away as 40 kc on the spectrum interfered at times.

The next step in eliminating interference was to use the beam antenna alone for receiving. Deviating from the usual practice of using one antenna for transmitting and receiving, a separate antenna of the beam type was installed for receiving only. As the entire territory it is desired to cover with the network lies *west* of the transmitter, the company was in a particularly fortunate position to use the beam antenna only. A three-element beam antenna with a front-to-back ratio of 30 db was used. Such a three-element beam antenna is obtained by using two parasitic elements, as illustrated, one as a reflector and the other as a director.

By the use of this combination it

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Degraded oil can be brought back by contact with ALCOA Activated Alumina—restored to an acid-free, sludge-free and moisture-free condition.

Oil, which has become badly contaminated, should be neutralized, cleaned and dehydrated with reclaiming equipment. Then kept in condition by means of a self-operating filter and breather, charged with Activated Alumina, and attached to the transformer.

This Book Tells How!—This 117-page manual was prepared for our own personnel, who maintain one of the largest industrial transformer installations in the world. You may have a copy for the asking. Here is what it covers:

1. Testing procedure
2. Maintenance procedure
3. Fundamentals affecting and controlling the performance characteristics of:
   a. Electrical insulating oil
   b. Hydraulic pressure system oil
   c. Lubricating oil

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ORANGEBURG* CONDUIT provides longer cable life for the following clear-cut reasons. Orangeburg's smoother bore and low coefficient of friction diminish the risk of *abrasion* when cable is pulled into duct—of *strains* from pulling tension—of *wear on sheath* from cable movement with changing loads.

Moreover, Orangeburg's tight taper sleeve joints and impermeable wall prevent *infiltration* of ground water—safeguard the cable against corrosive action.

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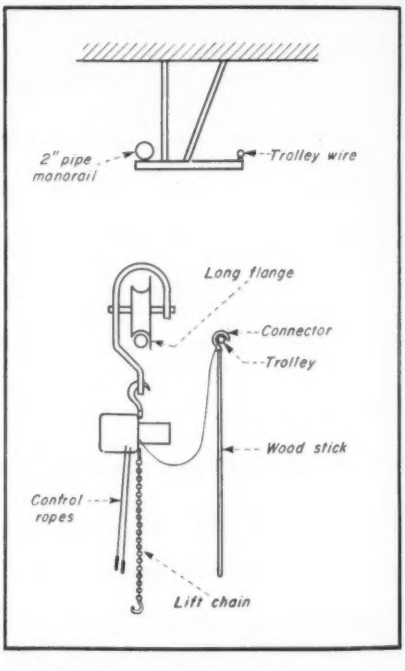
was possible to increase forward gain by about six times over our coaxial antenna and at the same time to cut down the Eastern interference by 50 percent. With this forward gain favoring the company's mobile units, it was possible to tighten the squelch control to eliminate another 30 percent of the interference. This came close to achieving the objective, but there are still occasional cases of foreign signals coming in. It is now planned to use another one or more reflectors, which with proper design should strengthen our own signal, give a wider coverage in the territory with no dead spots, and at the same time completely eliminate the last vestige of Eastern interference.

•

Monorail Conveyor Made on Simple Lines



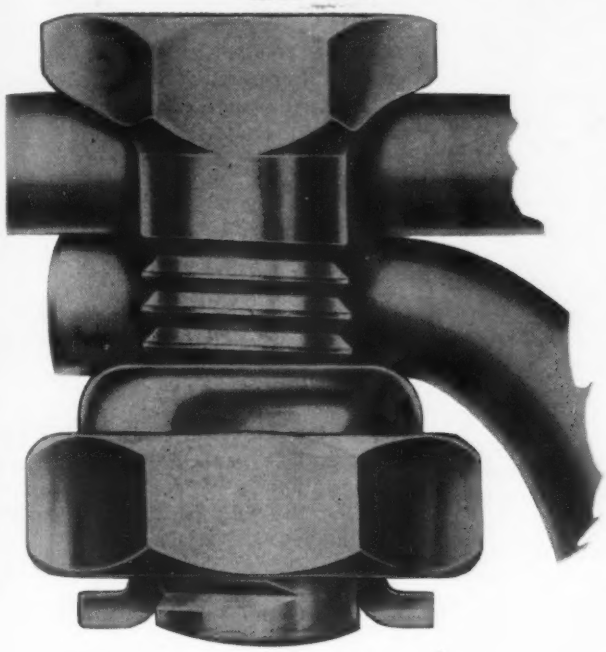
TROLLEY CONNECTION is made by the hook connector after the hoist is spotted over the load in this simplified conveyor system

AVOIDING the usual complications of trolley and connections of electric conveyors, the arrangement illustrated simplified construction of a monorail system in the repair shop of Gulf States Utilities Co, Beaumont, Tex. An electric motor hoist provides the lift and it can be pushed along the rail. While being moved, the trolley stick is hooked onto the hoist.

Use Tough

Kearnalloy BRONZE CON-NEC-TITES

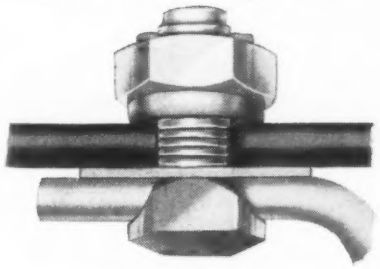
For Line Connections That Stay Tight– Without Nicking Line Wires



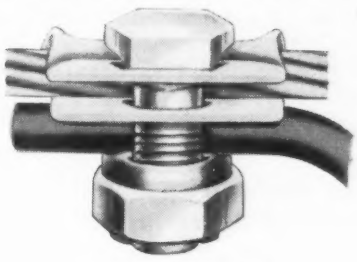
Con-Nec-Tites of the new Kearnalloy bronze are tough and mechanically strong enough to withstand high torque. Yet they are resilient enough to cushion against line wires and prevent nicking.

All Kearney Con-Nec-Tites have clean, uniform threads, thread lead pilots, V-groove surfaces in head and washer and correct slot width. Use tough, nick-free Kearnalloy Con-Nec-Tites for all types of connections.

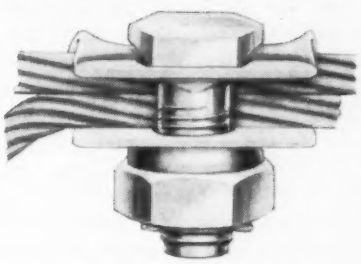
Eliminate Electrolytic Action—Use Plated Con-Nec-Tites



Copper to Aluminum



Aluminum to Copper



Aluminum to Aluminum

The cadmium plated Kearnalloy Con-Nec-Tites shown here prevent electrolytic action because the copper and aluminum wires never come in contact with one another. Use them to assure good conductivity and tight connections.

95

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DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards

Many Electrical Drives In Carbide Factory

From an article in "Electrical Review," London, June 7, 1946.

PRODUCTION of 80,000 to 90,000 long tons of calcium carbide a year at the new plant near Port Talbot, South Wales, uses a large amount of electricity apart from the furnaces, which furnish a load of 18,000 kw each, two out of three usually being in use.

The raw materials, limestone, coal and coke, are dumped in stock piles 120 ft wide and 1,400 ft long by a motor-driven traveling crane. Motor drive is used for the transport of materials, including delivery from stock to bunkers in the top of the building, feed through the preheaters, delivery to the kilns, transport of the pigs of carbide to the crusher and thence to storage bunkers.

Motor drive also is used for ball mills which pulverize the coal, for firing and exhaust fans, drive of the kilns, and crushers for the coke and for carbide pigs. Magnetic separators extract ferrosilicon, a byproduct, and electric welders are used in making drums for shipment of the product. Most of the motors are of medium size, and extreme speed reductions are used to obtain the very low speeds needed for the crusher and kiln drives.

Transportable Power Stations

From an article in "The Electrician," London, August 9, 1946.

NEEDS of devastated areas in Russia and elsewhere inspired the design of transportable power stations for emergency supply. These have offered possibilities beyond their war-time uses. A unit, developed by International Combustion, Ltd, has a two-drum water-tube boiler with all usual equipment and water-conditioning apparatus. It is arranged for oil, coal or dual firing, with a mechanical stoker. Evaporative capacity is 35,000 lb of steam per hr, a superheater of the horizontal gridiron type giving a final steam temperature of 680 deg F to the turbine steam, while saturated steam is used for auxiliaries.

The power unit, a 2,500-kw direct-coupled turbo-alternator complete with condenser and air ejectors, is mounted on a common girder structure. It weighs about 60 (long) tons, and can pass the international loading gage on a low-loading car, or road wheels can be fitted to the girder structure. The boiler is transported in five sections complete with supporting steelwork. These also are of a size within the loading gage, and no section exceeds 25 tons. The five sections are stoker, lower part of supporting structure, combustion chamber, pressure parts and economizer. Each section is designed for handling by an erection structure which is provided. The complete plant is designed to operate without weather protection, if required.

New Dielectrics For High Frequency

From an article in "Electrical Review," June 7, 1946.

MANY new dielectrics based on high polymers and ceramics suitable for radio frequency are being developed, although a number of them, including polytetrafluorethylene, are not yet available commercially. Plastics based on hydrocarbons, on account of their non-polar structure, possess low permittivity and power factor combined with low water absorption, but have lower temperature resistance than materials with polar groups. Composite dielectrics include low-pressure laminating resins with good mechanical and electrical characteristics when combined with glass cloth.

Ceramic insulators have been coated with firmly adherent metal films to which metal parts can be soldered; this technique is now being applied to assembly of components, hermetic sealing of tropical equipment, and, experimentally, to vacuum tubes. Use of titanium oxide has resulted in considerable improvement in quality of condenser dielectrics and markedly lower power factors.

Power for Electrolytic Processes

From a paper by T. R. Rhea and B. R. Connell (General Electric Co) before the Electrochemical Society, Toronto, October 16-19, 1946.

DURING the war the electrolytic industry was greatly expanded, and at present the installations of conversion equipment for the "big five" are distributed as follows:

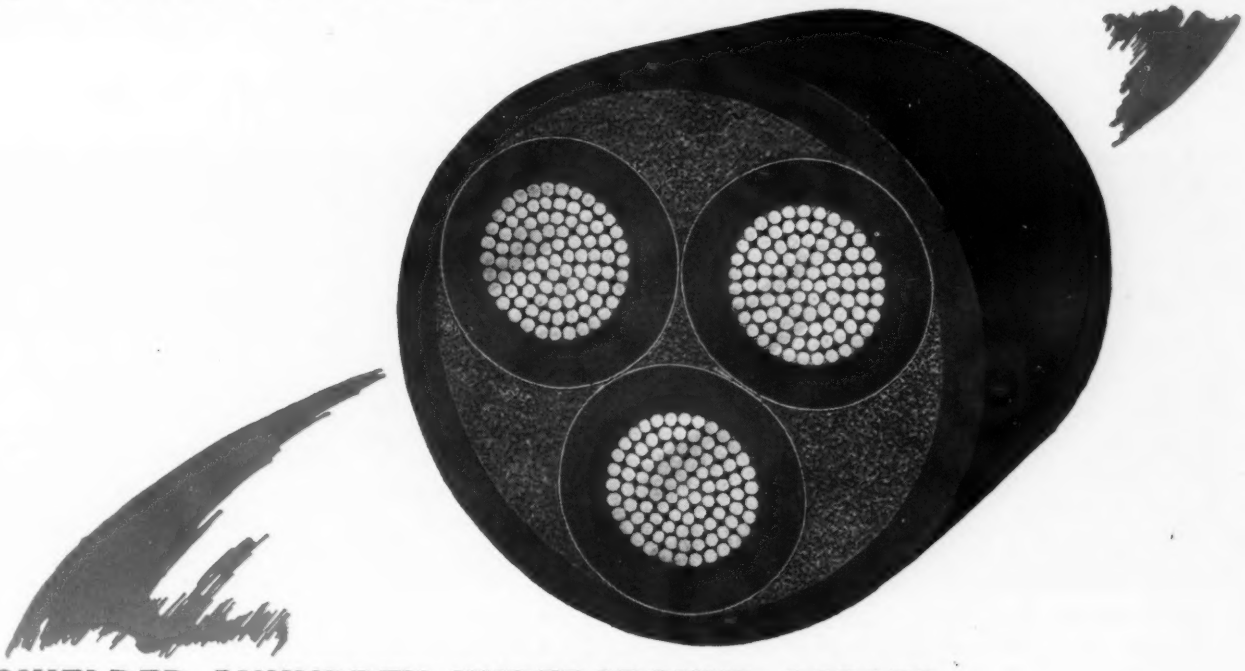
Summary of Electrolytic Conversion Equipment, U.S. and Canada

	Rating in Direct-Current Kilowatts		
	Rotating	Rectifier	Total
Aluminum	516,985	2,941,750	3,458,735
Magnesium	72,800	448,140	520,940
Chlorine	114,370	173,790	288,160
Zinc	169,100	58,736	227,836
Copper	55,230	0	55,230
Total	928,485	3,622,416	4,550,901

Mercury arc rectifiers have become so well established that almost no rotating conversion equipment has been installed for many years. Rectifier equipment is competitive with rotating at cell-line voltage of 250, total cost being $50 to $55 per d-c kilowatt. Below 250 volts rectifiers cannot compete in cost, but at all higher voltages they have the advantage. At 600 volts large rectifier units may be installed complete for $38 to $45 per d-c kilowatt. Rectifier efficiency is about 96 percent compared with 91 percent for motor-generators and 95 percent for synchronous converters. There are no commutation difficulties or synchronization troubles in starting after a shutdown.

At the peak of operation during the war the five processes listed consumed approximately 31,000,000,000 kwhr annually. Today most of the plants installed by the government are shut down. In addition to those listed, there are many electroytic processes such as sodium, hydrogen, oxygen, perchlorate, and others.

FOR HIGH VOLTAGE UNDERGROUND CIRCUITS



SHIELDED ANHYDREX UNDERGROUND CABLES

are especially designed to meet all requirements for high voltage underground systems.

In buried installations where crystallization, corrosion, and electrolysis menace lead sheaths, shielded ANHYDREX cables assure lasting, trouble-free service.

THREE-WAY PROTECTION IS THE REASON

- The metallic shielding over the insulation effectively transmits electrostatic discharges to ground and prevents deterioration by corona and ozone.

- The ANHYDREX insulation over each conductor features high dielectric strength and minimum water absorption. No other rubber insulating compound provides as much resistance to the dampness and moisture prevalent underground.

- The neoprene jacket withstands constant exposure to soil acids, oil, and abrasives. It is unaffected by vibration and eliminates sheath currents.

Shielded ANHYDREX Underground Cables can be installed without ducts or additional protective coverings. They reduce both installation and maintenance costs. If you face the problem of increasing high voltage transmission efficiency, let a Simplex engineer show you how these cables can be applied to the solution.

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LOAD BUILDING

Modernized Street Lighting Boosts Civic Pride

SMALL TOWN street lighting modernization pays just as big dividends as do the more pretentious relighting jobs in the large cities. So finds the little town of Marysville, Wash., where civic pride runs high as a result of the striking change from old to new shown by these views. Other street lighting modernization jobs are to be found in western Washington, and more will follow in the territory served by Puget Sound Power & Light Co as a result of this utility's liberal policy of helping to finance these improvements and the assistance it gives in engineering the jobs. In Marysville, small, widely separated lights have given way to light-directing units with 300-watt lamps, mounted 25 ft above the street on 16-ft mastarms on power company poles spaced about 90 ft apart. Cost to the 1,800 people in the town is less than four cents per person per month more than the old system for the 30 new lights on the main street. Decreased traffic accidents and increased street capacity accrue from this plan

• • •

Community Center Promotes Home Planning

COMBINATION KITCHEN and automatic laundry in Indiana Service's "Leisure Electric Home." Color is used extensively in this display

SIGNALIZING active return to the field of appliance promotion, Indiana Service Corp has recently re-opened the "Leisure Electric Home" in its Fort Wayne office building. Two display kitchens, a combination kitchen-automatic laundry, a conventional laundry, and a bathroom are equipped. Special care was used in the decoration of these rooms and color is used extensively—an idea that is often neglected in kitchen appliance displays.

Appliance display and demonstration is regarded as the center but not the full extent of promotion in the Fort Wayne plan. Four additional phases of the operation serve to interest public attention.

Facilities for meetings of various organizations are provided in the auditorium and the groups may prepare luncheons in the electric kitchen of the service center and then wash their own dishes in the dish washer available. Manufacturers and dealer

Build LINE SECURITY *with* CHANCE ANCHORS
. . . the *NEVER-CREEP* Bolts through Solid Earth

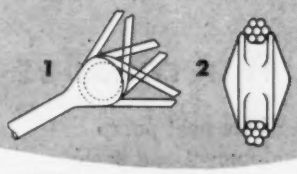
Chance Never-Creep Anchors offer the greatest possible line security under normal guying conditions because they are not dependent on the tamping of filled-in earth for their holding power. They pull entirely against solid, undisturbed earth. They are not subject to serious loss of holding power due to moisture seepage. Tests, over a period of many years, prove that moisture penetration has less effect on the holding power of Never-Creep Anchors than on any other type of anchor.

This dependability, plus ease, simplicity and speed of installation has made Never-Creep Anchors the preference of utility men for many years.

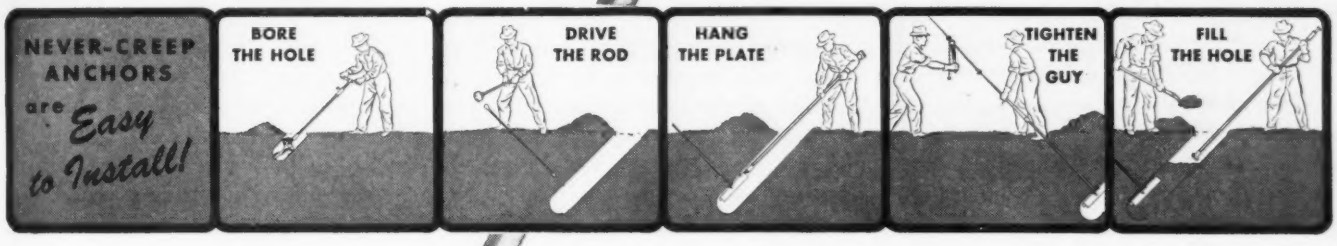
Now the Never-Creep has been improved by reinforced steel construction — it is better than ever before!

Improved Thimbleye Forged Steel Rod

This high strength, forged steel rod is pointed for easy driving through solid earth and features the famous improved Chance Thimbleye.



1. **Full rounded eye protects strand at varied angles, aids slack pulling.**
2. **Groove fits snugly around strand and prevents spreading.**



Reinforced STEEL PLATE

Never-Creep Anchor plates are formed of high strength structural steel, reinforced with a high carbon steel core plate. Three plates are welded together in the area of greatest pull. Creep guards are welded to the top of the plate. Socket has reinforcing ribs.

How much will an anchor HOLD?

Chance engineers have developed a new formula for determining the type and kind of anchor to use for every guying condition. Your copy is ready and will be sent upon request.

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abc INDUSTRIES

groups as well as various women's organizations are encouraged to hold their meetings in the electric home auditorium.

From the stage of the auditorium a local radio station broadcasts its homemaker program. The staff of the electric home frequently participates in the broadcast and also helps in developing some of the programs. Studio audiences of the program attract many people to the home center.

In addition to the kitchen and laundry layout service, information is also available regarding home building in general and scrap books may be consulted on color schemes, arrangements, floor plans, remodeling, decorating, and painting, etc. Complete kitchen layouts are studied and the best basic arrangement is developed and planned as a part of the service available to the customer.

The Indiana Service Corp does not engage in merchandising of any electrical appliances. Local dealers supply the appliances for the main floor displays, and these displays are then periodically rotated and keyed to the respective dealers handling them by means of placards. Manufacturers' literature is available to those customers who wish to examine it.

• • •

Where Does the Heat Pump Go From Here?

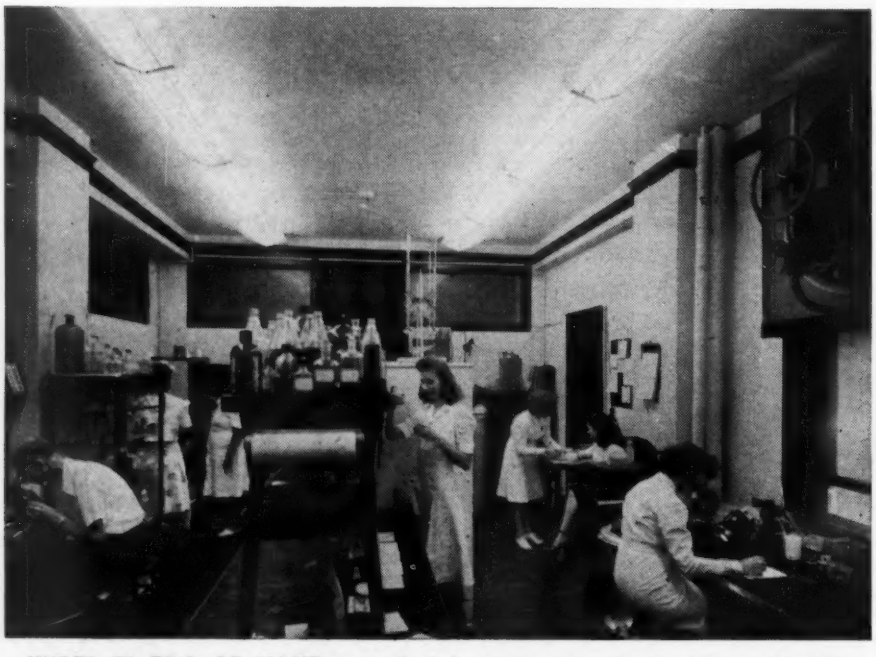
APPLICATION of the heat pump and its needs for development and promotion were dealt with in a paper by W. L. Holladay of Drayer-Hanson, Inc, Los Angeles, at the recent meeting of the Pacific Coast Electrical Association held at Riverside, Calif. On application, Holladay said, "all air-conditioning work is now engaged in a national trend toward year-round air conditioning. The gas industry has equipment for doing this. There are also many possible combinations of electrically operated summer cooling machines and fuel furnaces that will do it more or less adequately, but the heat pump will do it, automatically, using electricity as its only source of power.

"First costs are about the same for a heat pump as for any year-round air-conditioning system, though they will still seem high to prospects. That they should seem so is not surprising, in view of the fact that probably less than 400 heat pumps have been built by all manufacturers put together, and my company has built over 300 of them. Will prices come down? Probably, as the effects of competition, research, simplification and production begin to be felt. But in the meantime, and for some time to come, the market is one where a substantial first cost can be paid, such as commercial establishments, where more business can be done and more money made by making customers comfortable, and in luxury residences, where costs do not matter.

"Heat pumps are fairly large and bulky, compared to a furnace, though not in comparison to any year-round air-conditioning system. Compared with a furnace, they make a certain amount of noise, as would be expected from a 5-hp refrigerating machine. Therefore, space is needed, somewhat isolated from the occupied quarters in which to install the machine. This is easier to do in a store than in a house. The noise level in a store is also less critical than in a house. Structures well-built from a thermal standpoint does not mean all concrete and glass—it means insulation. The effect of insulation is not only to reduce equipment size and operating costs; it tends to equalize summer and winter loads.

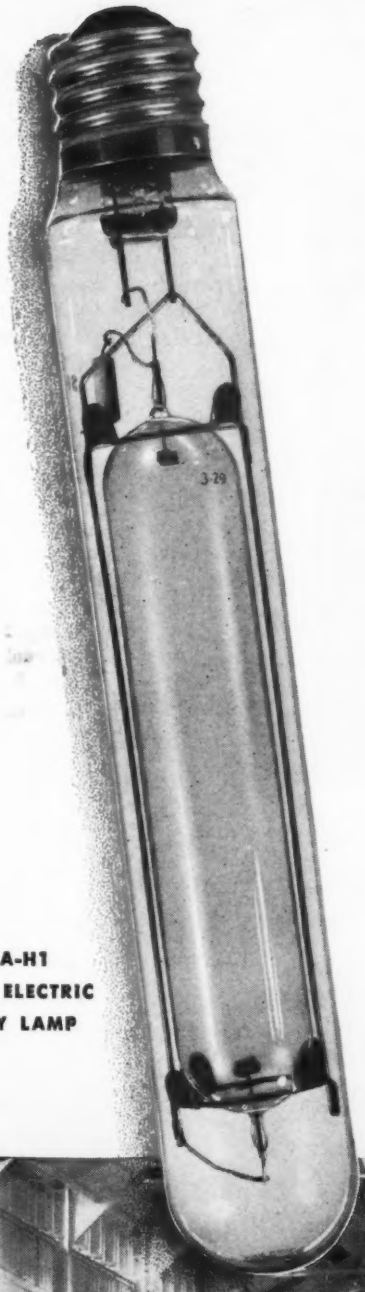
"These observations on the natural field of the heat pump are borne out by the sales experience of Drayer-Hanson in 1946. Of 85 Airtopia installations (90 actual units) in California, 68 are in commercial establishments, 17 in homes. If the desert installations, which obviously constitute a special case, are separated, it is found that 11 of the 29 desert jobs are in homes. In the normal climate areas, only 6 or 11 percent of the sales were in homes. It should be stated that these are not experimental or subsidized installations—they were *sold*, mostly by specialty salesmen making a living doing it."

Eight Times as Much Light as Before



UNDER 70 FT-C OF LIGHT. Instead of the previous 8 to 10, the folks employed in Mills' Laboratory, Tampa, Fla., work better and with less eyestrain in their exacting tasks. On recommendation of Tampa Electric Co. lighting engineers, the old semi-indirect lighting fixtures with 500-w incandescent lamps were removed and replaced by 20 surface-mounted fluorescent units, each with four 40-w tubes

MORE LIGHT FOR YOUR MONEY with G-E Mercury Lamps



TYPE A-H1
GENERAL ELECTRIC
MERCURY LAMP

LIGHT is a vital production tool. Better seeing means better workmanship, fewer accidents, higher plant morale. Now, with General Electric mercury lamps, proper industrial lighting levels can be maintained more economically than ever before.

Here are three reasons why G-E mercury lamps assure you *lowest cost of light:*

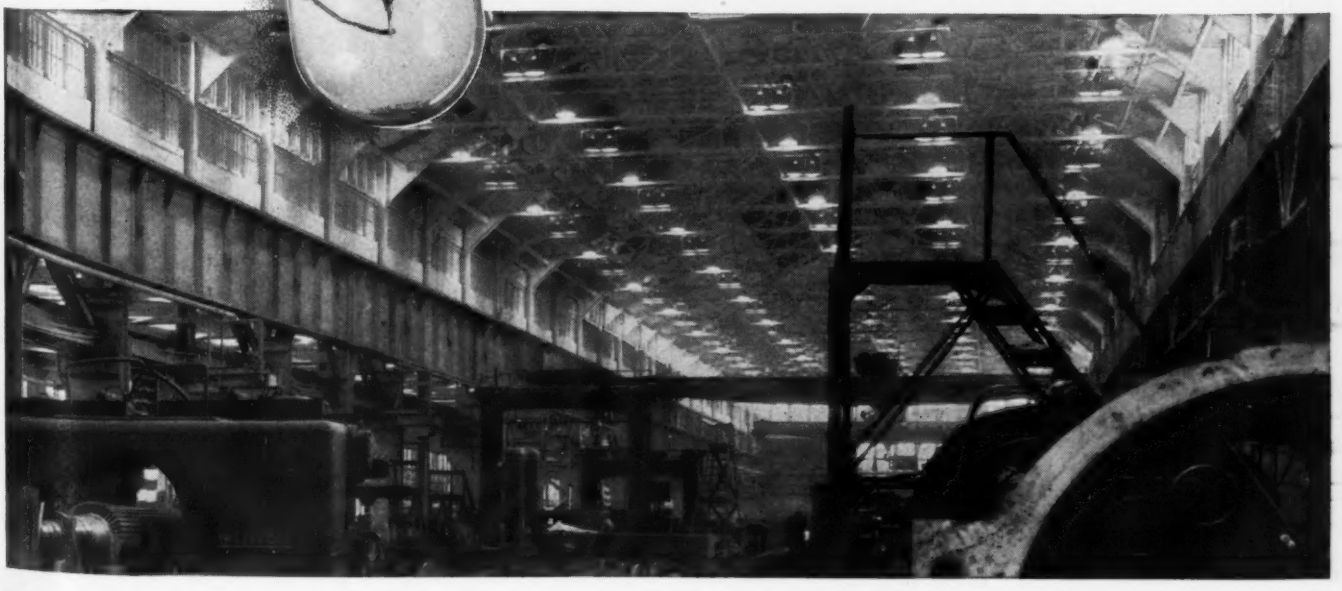
1. **HIGH EFFICIENCY**—Initial light output 40 lumens per lamp watt.
2. **LONG LIFE**—Up to 6000 hours rated life, depending upon wattage and number of starts.
3. **SUSTAINED LIGHT OUTPUT**—Lamps still produce 35 lumens per watt at 70% of rated life (burned 5 hours per start).

G-E mercury lamps are available in sizes from 100 watts to 3000 watts, for installation in a variety of fixtures. They combine well with filament lamps, installed on alternate staggered outlets. For full information, call your nearby G-E Lamp district office. or write for new booklet. General Electric Company, Dept. E-8-1, Nela Park, Cleveland 12, Ohio.

G-E LAMPS

GENERAL ELECTRIC

Average illumination of 40 foot-candles is maintained in this large machine shop by alternate staggered twin 400-watt mercury lamps and 1500-watt filament lamps. Mounting height 40 feet.



NEW EQUIPMENT

Industrial Arc Welders Have Illuminated Scale

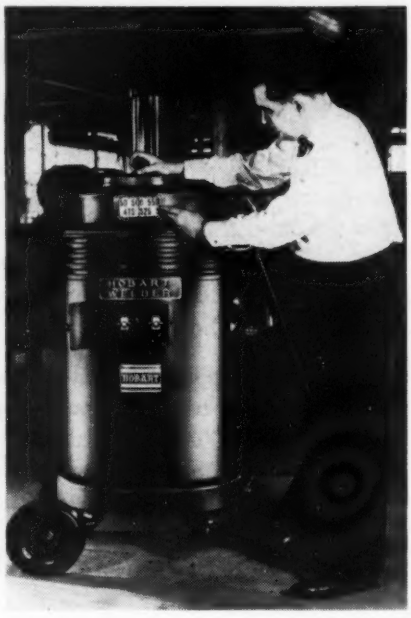
A LARGE illuminated current-indicating scale is the dominant feature of a new line of industrial type a-c transformer welders announced by The Hobart Brothers Co, Troy, Ohio. The dial of translucent plastic is illuminated from within by a 110-volt lamp which also acts as a tell-tale, indicating that the transformer is energized.

Both stationary and portable types of welders are offered in 300 and 500-amp sizes for operation on single-phase, 60-cycle circuit, either 220/440 volts, or 550 volts, also for 50 cycles.

The welders are the moving coil type (both primary and secondary coils move when adjustment is made) with no adjustable magnetic paths. By both coils moving, the time required to make a given change in welding heat is reported to be one-third less than would be required if one coil remained stationary. Adjustment of current is made by means of a convenient knob on a pressed steel disk that serves as the drip-proof top cover of the case.

All coils are made of glass-covered copper strap and all insulation is Class B. Circuit reactance and no-load voltage are stated to be so balanced as to make arc starting prompt and easy for any thickness of metal. Capacitors are built in the units for power factor connection.

All connections are enclosed in the case. Power supply cables pass through a knockout in the rear of the case to a three-stud panel. Welding cables pass through two holes in the front of the case to a two-stud panel.

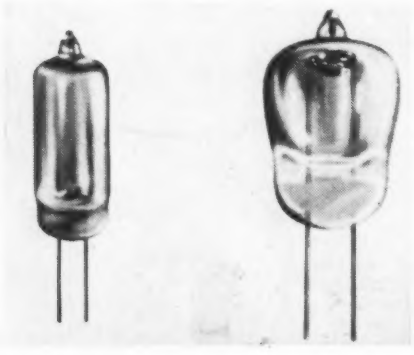


The case is of 16-gage steel. Opening in the underside is protected by a guard of expanded metal. A fan at the bottom of the case draws air through the drip-proof louvers at the top and expels it at the bottom of the case.

• • •

Mercury Switch Designed For Vertical Mounting

A VERTICAL mercury switch available in two models, one for upright mounting (left) and one for inverted mounting, (right) has been announced by Minneapolis-Honeywell Regulator Co, Minneapolis, Minn. As a safety control, the new switch will prevent damage to equipment because of oil failure, bearing wear, improper ventilation, or unusual strain on delicate parts resulting from tipping or upsetting of the equipment on which it is mounted. Among some of the applications for the new instrument are coin-operated machines, portable electric space heaters, machine tools and various electric appliances to which the switch may be attached.



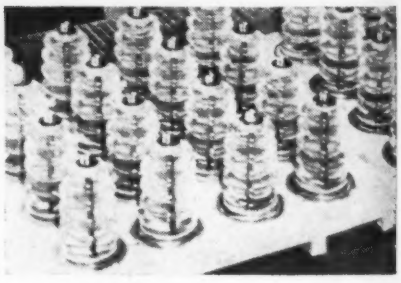
The switch is available in low- and high-capacity models of 1- and 12-amp ratings.

Capacitors Utilize Cast Glass Bushings

POWER-FACTOR capacitors using cast glass bushings with integral hardware that permits a permanent hermetically sealed unit have been announced by the General Electric Co, Schenectady, N. Y.

The bushings are made of low-expansion glass in which are cast metal inserts of a special nickel-steel alloy. A metal mounting flange cap is fused directly to the glass and the flange is in turn welded and soldered to the capacitor case, forming a hermetic seal.

According to company engineers, the bushings are practically unaffected by weathering, micro-organisms, and thermal shock. When excess potential of 60 cycles or impulses are applied, the



bushings will flash over externally rather than puncture or shatter, it is reported.

•

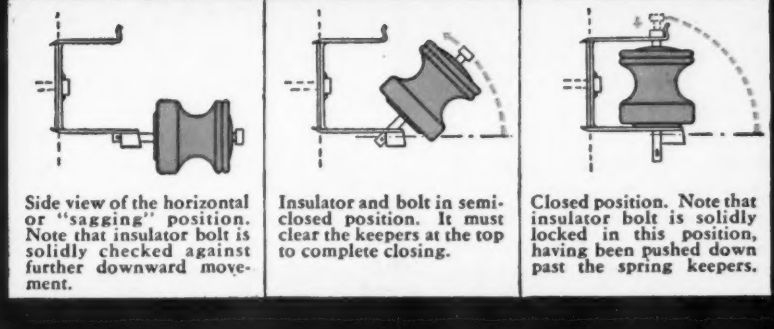
Panel Reset Timer Controls Industrial Operations

AN INDUSTRIAL reset timer, which starts at the touch of a button and, when the time cycle is complete, resets automatically, has been introduced by American Time Corp, Springfield 1, Mass. It is designed for panel mounting and comes in time cycle ranges of 15, 30, and 60 seconds and 5, 15, and 30 minutes. In addition to use on production machinery, it can be applied to x-ray machines, photocopy machines and therapeutic devices.

The timer is composed of two mounting plates, a reset synchronous motor, open-type jack switch, reset button, latch, cam, torsion spring, motor-actuated indicator, and adjustable stop. In-

Something NEW IN SECONDARY DISTRIBUTION

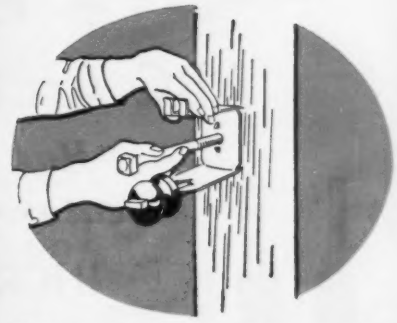
HUBBARD SAGGER BRACKETS



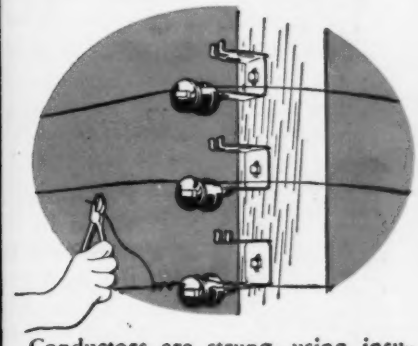
Side view of the horizontal or "sagging" position. Note that insulator bolt is solidly checked against further downward movement.

Insulator and bolt in semi-closed position. It must clear the keepers at the top to complete closing.

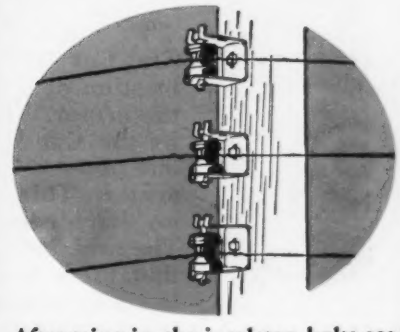
Closed position. Note that insulator bolt is solidly locked in this position, having been pushed down past the spring keepers.



Holes are drilled at correct spacing and machine bolt is inserted as shown.



Conductors are strung, using insulators as pulleys, until desired sag is obtained after which they are tied-in while still in the horizontal position.



After tying-in, the insulator bolts are raised to the vertical and dropped into the lock position.

For secondary distribution circuits, where a variety of problems are to be met, Hubbard No. 710 Sagger Bracket is the most flexible choice to meet the requirements. This Bracket may be described as a single, *separate,* secondary-rack point, which may be used with one or more similar points, at any desired spacing for any number of conductors.

No. 710 Brackets are versatile in other ways also. The patented feature is the arrangement of the insulator bolt which may be dropped to a horizontal position to allow the "sagging" of conductors with the insulator spool acting as a pulley. Insulator Bolts are locked in position when closed or open. Strength against line pull is provided by the broad back bearing against the pole, the backs being 3-inches in width. Spurs at the corners prevent the bracket from turning during and after installation. Bolt heads are trapped in the back to prevent turning while tightening.

Hubbard Sagger Brackets have been tested and proved in service. Highly adaptable to any conditions, they have drawn praise from engineers, in every instance of the many installations made to date.

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO **OAKLAND · CALIFORNIA**

CRESCENT

ABC Armored Cable

Has These Improved Features Which Result in

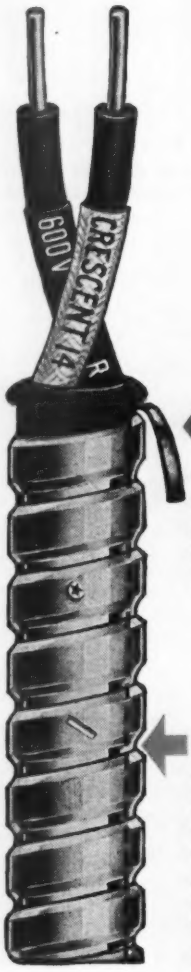
INCREASED SAFETY

and

LOWER COST

●

Bond Strip Under Armor



Permanently low armor resistance **is provided in sizes No. 14 and 12 AWG by use of a flattened bonding wire which is in contact with the under side of each convolution. These sizes now are smaller and lighter, since they use the smaller diameter Type R conductors of the 1947 National Electrical Code.**

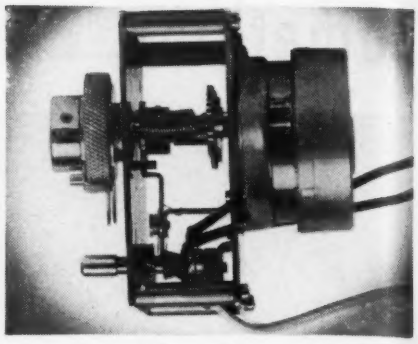
Prefabricated Break Lines

The Cut Mark (at 1½″ intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file guided by the Cut Mark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge — a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

The Armored Cable Industry is celebrating its 50th Anniversary. In the last 20 years alone over SIX BILLION FEET of Armored Cable have been installed.

CRESCENT
WIRE and CABLE

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.



ternal parts are of brass or cadmium-plated steel. It operates on a 110-volt, 60-cycle circuit and has a 1,500-watt capacity.

●

Analyzer Checks Capacitors in Circuits

A CAPACITOR-RESISTOR checker designated as type TO-3 DeLuxe Telohmike has been introduced by the Sprague Products Co, North Adams, Mass. The design is for fast, simplified operation and with a "speedy check" feature is said to enable the operator to locate open, intermittent or shorted capacitors without removing them from the circuit.

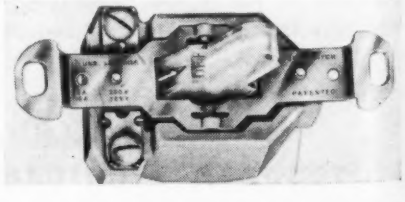
This bridge-type capacitance and resistance analyzer has a built-in d-c volt-milliammeter. Direct reading calibrated dial is color coded to correspond with selector switch. Capacity ranges are from 0.00001 to 2,000 mf in four steps. Resistance ranges are 2.5 ohms to 25 megohms in three steps. D-c meter range is 0-15; 150-750 volts; 0-1.5, 15, and 75 ma. Insulation resistance range indicated by direct meter reading is 0-2,500 megohms. Electrolytic leakage is measured in milliamperes at rated d-c voltage. Capacity and power factor of electrolytic capacitors are measured with rating polarizing voltage applied. Power factor measurement range is from 0-50 percent at 60 cycles.

The new instrument is only 13¼ in. wide, 10⅛ in. high and 5 in. deep and weighs 15 lb.

●

Electric Wall Switch Has Light in Handle

A NEW TYPE of wall switch equipped with a neon light in the switch handle has been introduced by Roberts-Glo.



SOME LINEMEN
CALL THEM . . .

"AUTOMATICS"

because
they go up

FAST and EASY

Liberal safety zone for burred wires
Release slot
One piece Duronze gripping unit
Four jaws firmly set as one unit by line tension
Phosphor bronze spring
Copper shell

FARGO LINE SPLICES

Available in sizes from #8 to 250,000 CM

ENGINEERS LIKE THEM

1. All parts are equal to or better than copper in "weather-ability."
2. They make a permanently low resistance connection.
3. The connection is as strong as the conductor itself.
4. The over-all cost of an installed Fargo Splice is low

LINEMEN LIKE THEM

1. No extra tools are needed to install them.
2. Safe to use when working in cramped "danger zones."
3. Sag guide helps linemen to properly sag lines.
4. Large safety zone to accommodate burred ends of wire.

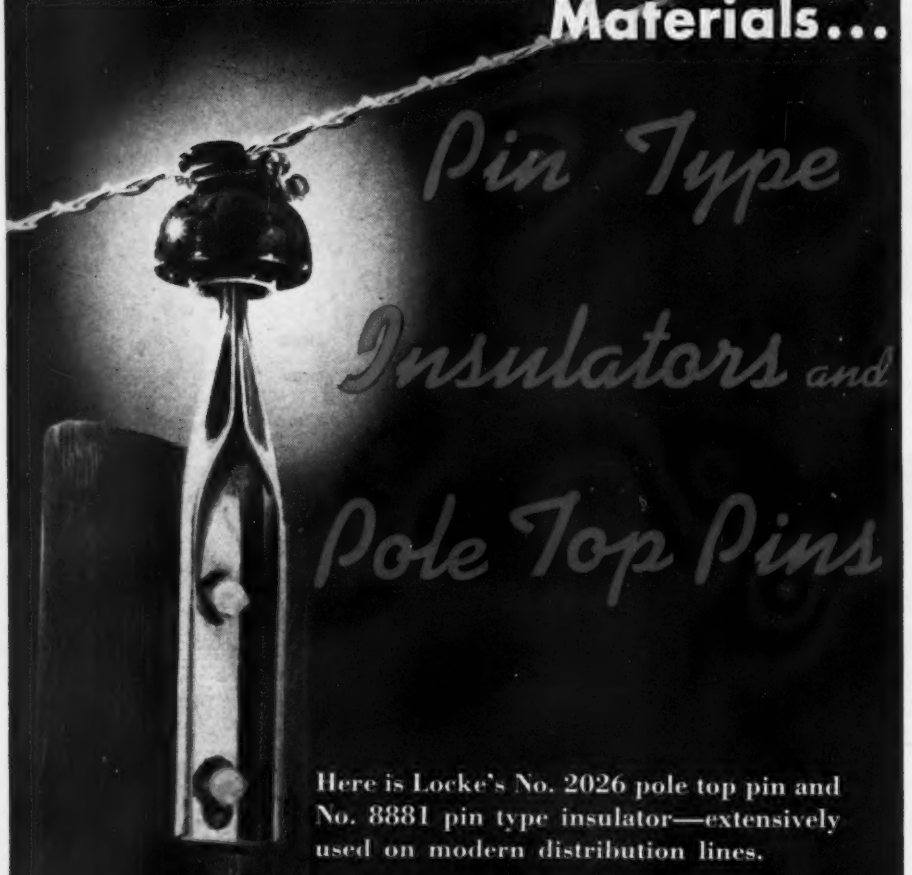
ELECTRONS LIKE THEM, TOO

"—the over-all resistance of splice plus contacts is less than the equivalent lengths of conductor—."

FARGO MFG. COMPANY, Inc.
ESTABLISHED 1914
Poughkeepsie, N. Y.

Full Fargo Line Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin.
(Representatives in principal cities)

Look to Locke for Distribution Materials...



Here is Locke's No. 2026 pole top pin and No. 8881 pin type insulator—extensively used on modern distribution lines.

Accurately formed pin threads allow the insulator to seat properly and develop its full strength. The lead alloy cob is positively bonded to the steel pin—no loosening from vibration. And with *Permazinc*—Locke's *Quality Controlled* double hot-dip galvanizing—for added years of dependable service.

The insulator is of wet process porcelain for best electrical characteristics, with *Compression Glaze* — originated by Locke — for highest mechanical strength. Pins and insulators are designed together and made together to work together.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Get in touch with your Locke representative or distributor.

Depend on Locke for ***Quality Controlled*** distribution materials—pole line hardware and insulators. *One* order covers *both*.

Locke **POLE LINE HARDWARE** *and* **INSULATORS**

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

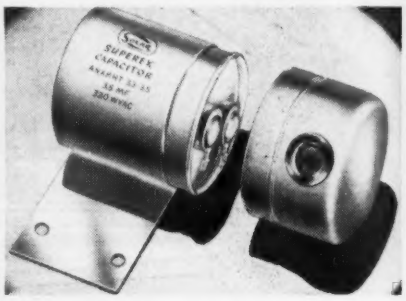
Switch Division, 700 Jamaica Ave, Brooklyn 8, N. Y. It is so designed that when the room lights are on the light in the switch handle is out— and vice versa.

The switch is of the single-pole type and will fit any standard receptacle. The switch handle is renewable. The light in the handle is said to have an expected life of two years.

•

"Snap-Cap" Capacitors Eliminate End Bells

A NEW DESIGN of a-c capacitors for small motors is being introduced by Solar Mfg Co, 285 Madison Ave, New



York 17, N. Y. A "snap-cap" arrangement and heavy-gage container is said to enable the new unit, type ANXRHT, to comply with Underwriters' requirements, without supplementary end-bells and brackets. The "snap-cap" is easily removable and permits the motor leads to be soldered directly to the capacitor terminals.

The capacitors are filled under vacuum with a non-flammable synthetic impregnant. The company reports the units are designed for use under high operating conditions.

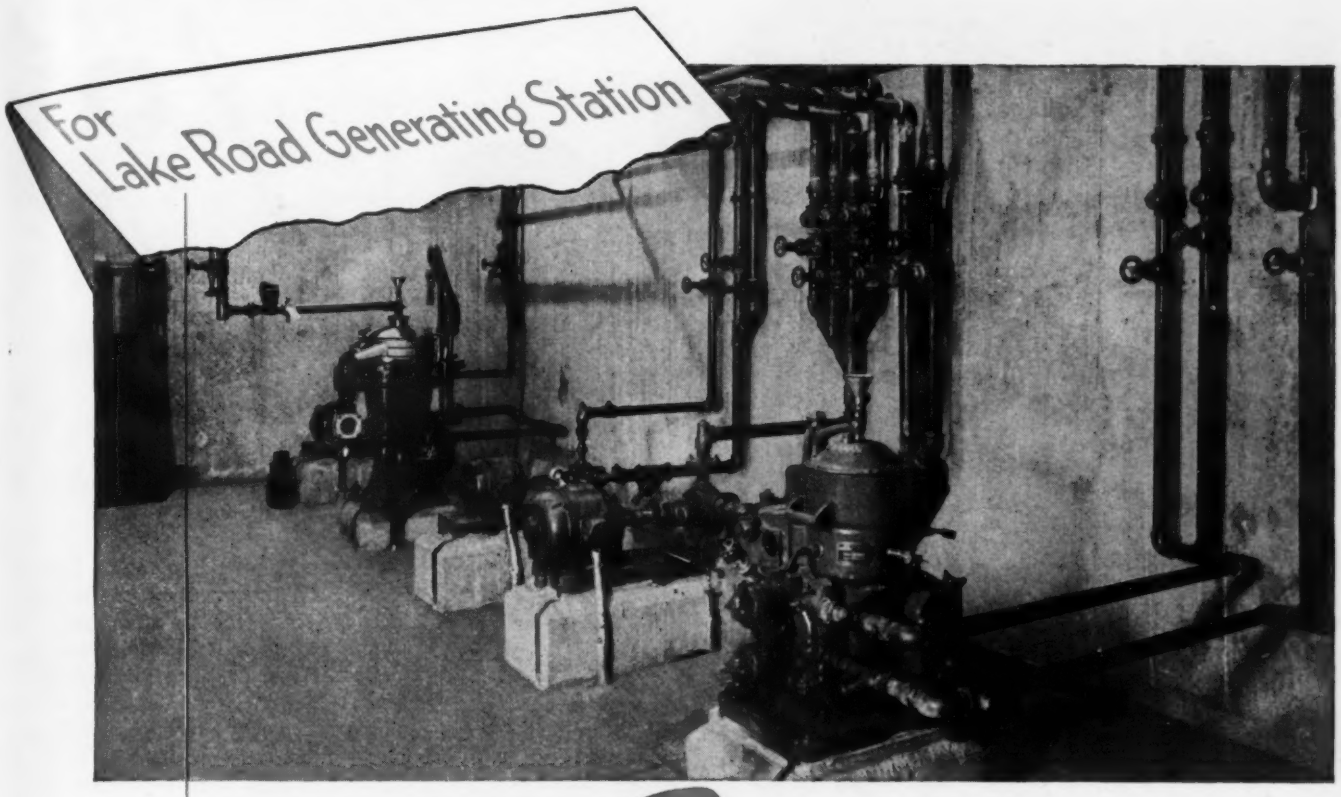
•

Truck Controller Has New Finger Design

TO MEET a requirement of greater current carrying capacity and faster positive action, Elwell-Parker Electric Co, Cleveland, Ohio, has developed a new type of controller, heart of which is a series of nine "trigger fingers."

In the Rolotac, each finger comprises a trunioned tube which houses a spring enclosing a plunger. A tubular sleeve or piston fits inside the upper end of the tube and outside the plunger spring. Trunions are supported on arms in the controller frame. Lower end of the tube is fitted with a pivoted bronze block, to which is attached a heavy flexible copper lead, and also a terminal contact.

In action a cam follower compresses and then releases the spring which con-



Oil that is *Dry* and free from *Dirt*

AT Lake Road Generating Station, Cleveland, a De Laval "Unit-Matic" and another De Laval Oil Purifier keep the turbine oil in good condition. They remove ***both*** of the impurities that cause turbine oil to lose its lubricating effectiveness — ***dirt*** and ***water***.

Water is discharged continuously, immediately upon its removal from the oil by means of centrifugal force. It is impossible to prevent a certain amount of water from getting into a turbine lubricating system, but a De Laval Oil Purifier enables every operator to be ***sure*** that the water does not remain in the oil to accelerate the formation of sludge.

Wherever water removal is necessary to good lubricating oil performance, De Laval Oil Purifiers have another advantage — they have ample reserve capacity to remove an unexpected "slug" of water due to a sudden leak.

De Laval centrifugals in removing dirt from the oil store it out of the zone of purification. When it is so easy to get double protection for your turbine, why be satisfied with any less efficient means? Write for Bulletin TO-1.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval

LUBRICATING OIL PURIFIERS

IT'S VERSATILE—Used for detecting and diagnosing trouble in nearly all types of electrical equipment including: motors, generators, transformers, switchboards, appliances, lighting circuits, meters and relays . . . practically *everything* electrical.

IT'S EASY TO OPERATE—Simply make connections, turn the crank and take a direct reading. It's as simple to read as a voltmeter. Ratings up to 50 megohms, 500 volts.

IT'S CONVENIENT—Requires no external power supply, no adjustments, no batteries or replacement parts. DC test current is supplied by a self-contained hand-operated generator—an unfailing source, *always* ready for use.

IT'S INSURANCE—Insulation testing with a "Megger" Tester is your first line of defense in electrical preventative maintenance . . . your protection against moisture and other enemies of electrical insulation . . . a *must* in your struggle for uninterrupted electrical service.

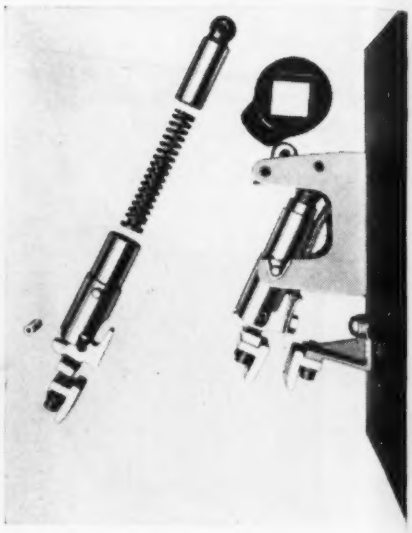
* Trademark Reg. U. S. Pat. Off.

READ THIS BULLETIN . . . Here's the ABC of the Midget "Megger" Insulation Tester, telling briefly and in common sense language just what the Midget "Megger" Tester is, how it is used . . . AND . . . what it will do for you. Write for your copy of Bulletin 1785-W *today*.

James G. **BIDDLE CO.**

ELECTRICAL & SCIENTIFIC INSTRUMENTS

1316 ARCH STREET • PHILADELPHIA 7, PENNA.



trols pressure of the plunger. The tip of the finger's contact is instantly rocked against the tip of a fixed terminal. Toggle action of the finger then rocks the contact under firm pressure against the fixed terminal. Due to the contour of the two terminals, first and final contact between them is made at their tips rather than over their entire current carrying surfaces, thus protecting those surfaces. Heavy currents are in make or break under magnetic blow out.

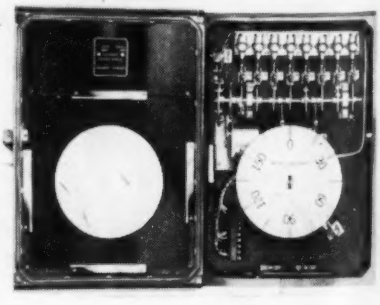
Interchangeability of fingers and their components and the large accessible contacts are features of the device, which is housed in a tamper-proof and shock-proof case.

•

Time Cycle Controller Actuates Switches

A NEW multiple-cam, time cycle controller, known as Model C500 Impulse-Sequence Cycle Controller, for timing mechanical operations in industrial processes has been announced by Bristol Co, Waterbury 91, Conn. It is designed for use on plant processes where a number of factors, such as opening and closing of valves, switches, dampers, retorts, and the starting, stopping or reversing of motor-driven pumps are to be timed according to a fixed program.

Time measurement and pilot valve operation are handled by separate mech-



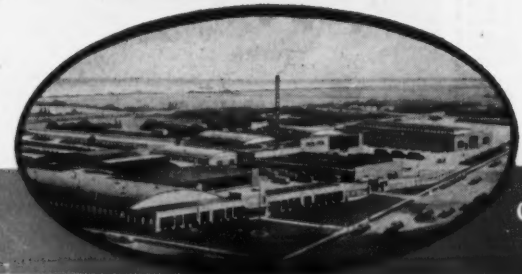
Series 25M (½ ton chassis)
and 35M (¾ & 1 ton chassis)
Meter Installation & General Service Body

ALL-STEEL

POWERS

PUBLIC UTILITY BODIES

EMERGENCY or ROUTINE
Meter Installation and
General Service Work



LINE BODIES • SERVICE BODIES • POLE TRAILERS • SPECIAL EQUIPMENT

McCABE-POWERS AUTO BODY CO., 5900 N. BROADWAY, ST. LOUIS 15, MO.

Over 75 years experience!

—here's how to SAFEGUARD it!

Apply carbon dioxide with a Kidde Total Flooding System

Even *unattended* substations are thoroughly fire-protected at all times—with a *Kidde* Total Flooding System on guard!

When automatically operated, a *Kidde* System acts almost the instant a fire starts. Carbon dioxide pours into the entire protected space . . . swirls around obstructions . . . penetrates through complex wiring and into windings. *Wherever* the flames are, they're killed in a matter of seconds.

Manual operation is available too, of course, if it meets your requirements better. Multiple protection also if needed —with a single bank of cylinders guarding two or more hazards by means of directional valves.

Remember . . . carbon dioxide is dry, inert, non-conducting, clean.

A Kidde representative will be glad to discuss Total Flooding Systems, as applied to *your* requirements.

Walter Kidde & Company, Inc., 830 Main Street, Belleville 9, N. J.

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Kidde

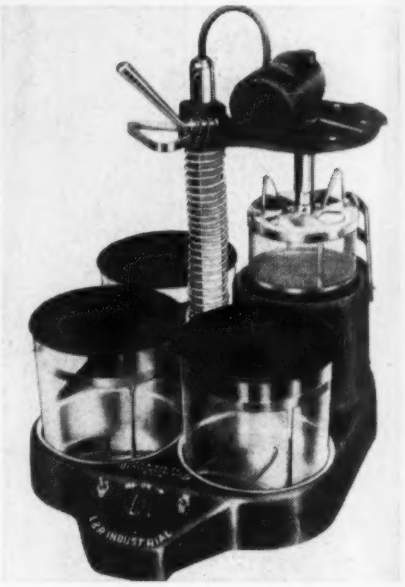
FIRE PROTECTION HEADQUARTERS

anisms. Timing is accomplished by a Telechron-driven aluminum disc on which is printed a 25-in. time scale. The desired schedule of operations is incorporated into the controller by cutting notches on the scale. Location of the notches determines the time of operation of the cam mechanism. Time impulses are transmitted electrically. Cams are individually adjustable.

•

Instrument Parts Cleaning Machine Improved

SEVERAL IMPROVEMENTS have been incorporated in the new small parts cleaning machine now being produced by



L & R Mfg Co, Arlington, N. J. Now incorporated are a specially designed ball bearing motor and a new shaft that supports the work basket. The basket is 3⅜ in. deep and 5½ in. in diameter, into which triple nesting baskets fit so that parts will not become mixed.

The unit is also furnished with controlled reversing action. Aluminum cups are provided under the jars to provide more protection for the Pyrex glass jars. The unit is self-contained, cleans, rinses, polishes and dries small instrument and machine parts.

•

Neutral Bar Accommodates Up to 42 Outlets; 225 Amp

A NEW TYPE of neutral bar with capacities up to 225 amp and with provisions for up to 42 taps is being introduced by Ilsco Copper Tube & Products, Inc, Mariemont, Cincinnati, Ohio. The bar is made in three standard sizes—70, 125 and 225 amp.

The company reports these as ap-

"Tops in '26...even better today"

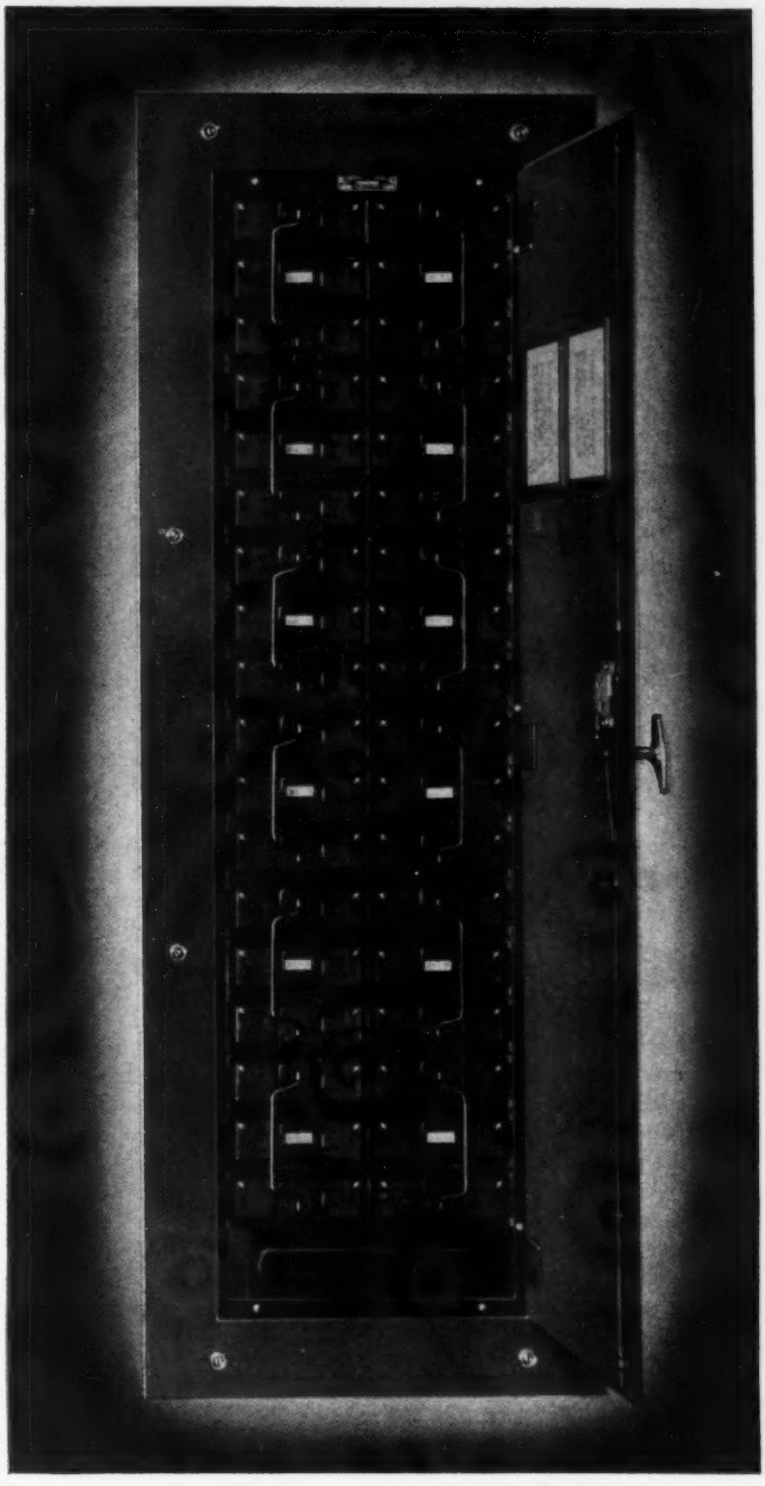
WHEN plant changes or expansions call for new circuits—the electrician knows it will be easy to modify any BullDog SafToFuse Panelboard . . . the flexible panelboard with interchangeable fuse units.

BullDog SafToFuse Panels are compact—primarily intended for those installations where space is at a premium. Because SafToFuse units are standardized, supplemental units can be added, or units of different capacities can be substituted with a minimum of expense and delay.

All current carrying parts and fuses are fully shielded when in service . . . no chance for an accidental contact. If it becomes necessary to replace a fuse or disconnect the circuit, the fuses are removed by pulling out the SafToFuse "head" . . . double protection; also eliminates the need of auxiliary "fuse pullers." Moreover, provisions are made to test fuses—without current disconnection —through holes in the face of the unit.

For maximum flexibility and interchangeability in power distribution, specify BullDog SafToFuse Panelboards . . . tops for twenty years. They'll help you stop your power problems before they start.

A BullDog Field Engineer will appreciate an opportunity to demonstrate the advantages of SafToFuse Panelboards and show you an installation near your own plant. Call him today, or write BullDog direct.



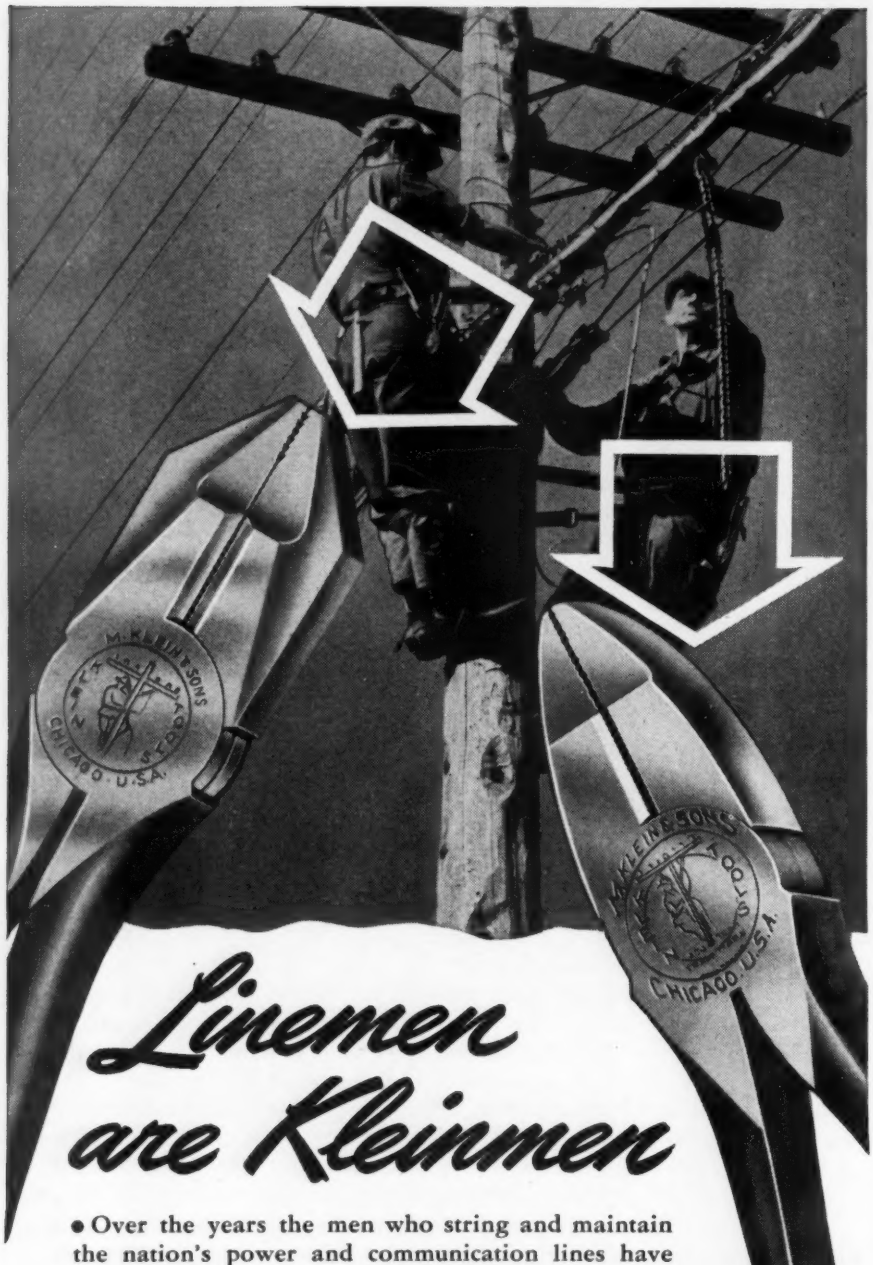
BullDog manufactures Vacu-Break Safety Switches—SafToFuse Panelboards—Superba and Rocker Type Lighting Panels—Switchboards—Circuit Master Breakers—"Lo-X" Feeder BUStribution DUCT—"Plug-in" Type BUStribution DUCT—Universal Trol-E-Duct for flexible lighting—Industrial Trol-E-Duct for portable tools, cranes, hoists.

BULLDOG

ELECTRIC PRODUCTS COMPANY

ADEQUATE WIRING SERVES AND SAVES

DETROIT 32, MICHIGAN. FIELD OFFICES IN ALL PRINCIPAL CITIES. IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO



Linemen are Kleinmen

• Over the years the men who string and maintain the nation's power and communication lines have come to know and rely on Klein Pliers. That's why you will find Klein Pliers in the hands of the man on the pole—why linemen are Kleinmen.

And there's good reason back of this preference for these quality tools. Drop forged from fine alloy steel, each pair individually tempered and tested, Kleins have just the proper balance . . . just the right spring to the handles to minimize hand fatigue. A fitted hinge keeps jaws perfectly aligned . . . carefully matched knives stay keen.

Keep Klein Pliers on order—your supplier will meet your requirements as soon as possible.

Ask Your Supplier

***Foreign Distributor:* International Standard Electric Corp., New York**

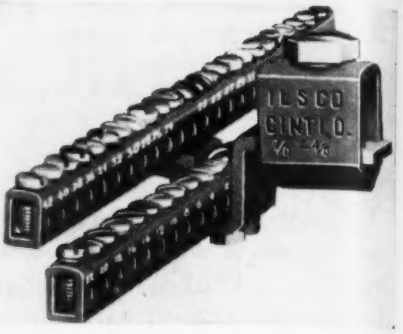
A copy of the Klein Pocket Tool Guide, showing the Klein line and containing valuable tool information, will be sent on request.

Since 1857

Mathias KLEIN & Sons

Established 1857 — **Chicago, Ill., U.S.A.**

3200 BELMONT AVENUE, CHICAGO 18, ILLINOIS



proved for 14, 30 and 42 outlets respectively. Bars with different numbers of outlets are made as specials. Distance between outlets is 1 63/64 in.

•

Appliance Tester Is Pocket-Size

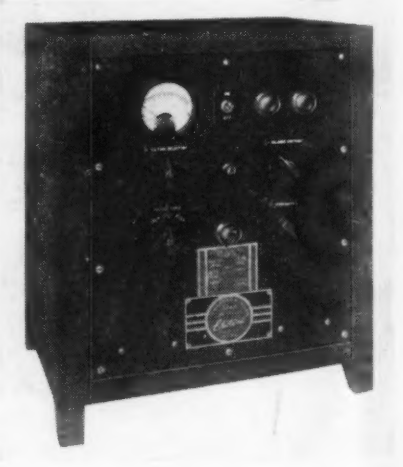
GIVING volt, ampere and wattage readings in a compact unit, an electrical measuring instrument, known as Model 390 and reported "no larger than a man's hand," has been made available by Simpson Electric Co, Chicago, Ill. According to the manufacturer, it will test practically any household appliance that has a motor or a heating element and will serve certain industrial installations as well.

The instrument is furnished with a break-in plug which has four color-coded leads. Leads are first attached to the instrument, then the plug is placed in an electrical outlet and the appliance to be tested is plugged into it. Meter ranges are: 60 cycles; volts, 0-150, 0-300; amperes, 0-3, 0-15; watts, 0-300, 0-600, 0-1,500, 0-3,000.

•

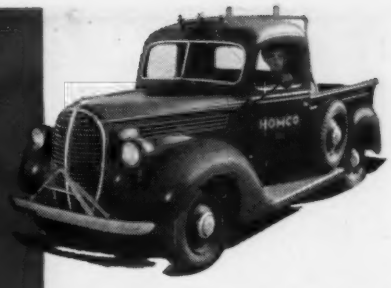
Voltage Regulator Corrects on 1/10-Volt Drift

AN AUTOMATIC electronic voltage regulator which corrects for drifts of



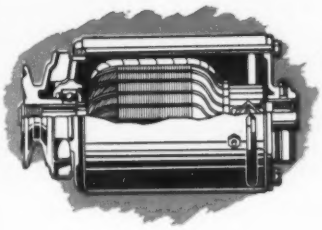
"Certainly FORD TRUCKS LAST LONGER!"

"That's why we operate 207 of them!"—says C. R. Littlepage, Supt. of Transportation, Houston Oil Field Material Co., Houston, Texas.



Two 1939 Ford Trucks owned by HOMCO that prove the point: (Above) Driver Joe Zachary and Pickup, mileage 207,316; (Below) Driver H. O. Carpenter and Pickup, mileage 228,398. Supt. Littlepage adds: "Our Ford Trucks deliver trouble-free miles at minimum cost!"

One BIG Reason—
FORD ELECTRICAL UNITS STAND UP!



The fame of Ford Trucks for swift, sure starting and all-weather reliability rests solidly on Ford design and Ford quality . . . in particular, the Ford Electrical System. More than 12 million Ford-designed starter motors and generators have been built in Ford shops. Repeated tests for electrical efficiency consistently prove these fine, Ford-built units to be outstanding. Long, trouble-free generator service is assured by such long-life features as pre-lubricated, sealed ball bearings on armature shafts, and by bushings wick-lubricated from a reservoir with an overflow drain, which prevents surplus oil from reaching commutator. Ford starter motors are pre-lubricated, requiring no oiling whatever. Ford wiring and generous battery and generator capacity adhere strictly to the highest standards of the industry. The simplicity and high efficiency of the Ford starting system circuit, too, have much to do with Ford's faithful starting performance.

Ford

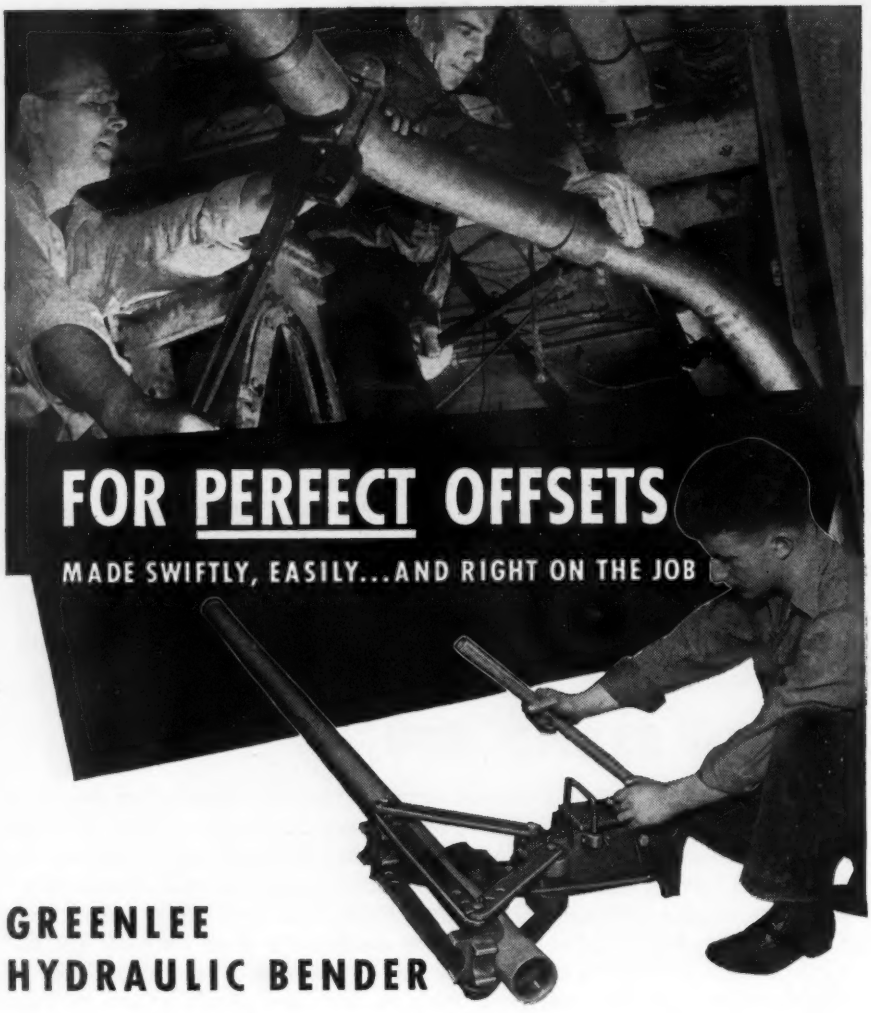
THE 6 YOUR PICK OF POWER THE V-8

Special body and chassis equipment in widest variety is available for the popular Ford heavy duty chassis through Ford Dealers everywhere. Illustrated is a saver of back-muscles and time—the "Lift-Gate," a hydraulically operated loading and unloading device for heavy merchandise, manufactured by Anthony Co., Streator, Ill., applied to Ford heavy duty chassis equipped with 2-unit van body by Boyertown Auto Body Works, Inc., Boyertown, Pa.

For swift, curb-level loading without obstructing traffic or straining muscles. When truck is loaded, "Lift-Gate" swings up like an ordinary tailgate.

Only Ford Brings You All These Long-Life Features: Your choice of engines, V-8 or SIX —each with new Flightlight oil-saving 4-ring pistons and precision bearings · true truck frames in all models, with siderails *doubled* in heavy duty units · rear axle shafts free of weight-load, ¾-floating in half-ton units, full-floating in all others · big, easy-action brakes with non-warping, score-resistant cast drum surfaces—in all, *more than fifty* such endurance engineering features! And more than 100 body-chassis combinations to choose from. See your Ford Dealer now!

MORE FORD TRUCKS IN USE TODAY THAN ANY OTHER MAKE!



"Accuracy in offsetting is one of the big features we like in the GREENLEE Bender," reports Perry Electric Company of Hartford, Connecticut.

"On a sixty-foot tunnel job with a series of complicated bends, for example, we saved a lot of time with our GREENLEE. Compared with old methods of conduit bending and installation, the work goes six times faster," continues the report.

Let a GREENLEE make valuable time and material savings for you, too. *One man* operated to quickly produce smooth, accurate bends in pipe up to 4½", rigid and *thin wall* conduit, tubing, bus-bars. Compact, portable, easily set up. Eliminates need for many fittings and the work of installing them. And, most important, helps produce jobs of fine appearance.

Whatever your bending job, there's a GREENLEE to do it. Get complete facts on GREENLEE Hydraulic and Hand Benders. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1808 Columbia Avenue, Rockford, Ill.

TOOLS FOR CRAFTSMEN
GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Benders • Cable Pullers • Radio Chassis Punches • Pipe Pushers

plus or minus one-tenth volt has been announced by Richardson-Allen Corp, 15 West 20th St, New York 11, N. Y. It is designed to operate on 115-volt, single-phase, 50/60-cycle circuit. Standard model is for 1- to 9-volt d-c output. Specials for other circuit conditions have been designed.

The unit is said to maintain constant voltage with any current load. It was designed especially to operate with the company's motor-driven stepless control but is reported to be adaptable to all motor-driven remote controls.

•

Motor Generator Unit Develops 400 Cycles

A RECENT DEVELOPMENT of the Kato Engineering Co, Mankato, Minn., is a compact high-frequency unit consisting of a 14-pole, 3,440-rpm, 1000-va, 400-cycle generator and a 4-pole d-c motor, with both armatures on same shaft. Manufacturer reports voltage regulation approximately 10 percent with 60 percent power factor load and approximately 7 percent regulation with unity power factor load; over-all efficiency about 50 percent. The unit is 23⅛ in. long, 12⅜ in. wide. 13⅜ in. high and net weight is 210 lb.

•

Instrument Checks Temp From —50 to 50°F

COLD ZONE TESTER for checking operating temperatures of refrigerating equipment has been announced by J-B-T- Instruments, Inc, New Haven, Conn. Known as Model 50-50, it has a range of —50 to +50 deg F. The temperature element has a 14-ft polyethylene lead to connect with the temperature indicating instrument. The lead is said to remain flexible at —50 deg and to be thin enough not to interfere with the weatherstrip.

CATALOGS and BULLETINS

A monthly digest of recent manufacturers' literature compiled by Electrical World for your convenience in securing without obligation the most recent information on electrical and allied products.

CHECK ON COUPON BULLETINS DESIRED AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS

1 INSULATING VARNISHES: Catalog announcing and describing the company's new line of electrical insulating varnishes and compounds. It includes information on properties and application techniques and contains many photographs of impregnated coils. The Acme Wire Co.

2 POTHEADS: Publication No. 4607 lists and describes a line of single-conductor cable terminators which are of the sealed type and designed for indoor or outdoor service. They are listed in ratings up to 46 kv and all standard ampere capacities. Delta-Star Electric Co.

3 LIGHTING: A new bulletin entitled "America's No. 1 Lighting Job" describes and illustrates the relighting of West Point with the company's new units. It contains information brought out by the lighting research and eyesight studies which formed the basis for the installation. Edwin F. Guth Co.

4 TRANSFORMERS: A new transformer demonstration chart has been developed to show how banked secondary transformers operate under overload or fault conditions. Various system conditions are indicated on a disc which turns to show operation of bimetals and signal lights as transformer load increases, opening contacts, and darkening houses when the fault or excessive load is sectionalized. Westinghouse Electric Corp.

5 LINEMEN'S EQUIPMENT: A new pocket-type catalog which shows the company's complete line of belts, safety straps, climber straps and pads, tool pouches, etc., has been released. Utilities Safety Supply Co.

6 TEST EQUIPMENT: Data sheet 69 illustrates and describes the company's Hydro-pneumatic Power Unit which develops hydraulic pressures up to 20,000 lb by utilizing air pressures of 100 lb. It is applicable for hydrostatic test service. The Aldrich Pump Co.

7 FIRE EXTINGUISHERS: Data guide of the slip-stick variety facilitates the selection of the proper extinguisher for class "A," "B," and "C" fires. Also tabulates characteristics of the extinguishers. Randolph Laboratories, Inc.

8 MOTOR STARTERS: Bulletins 1075-B, 1076-B, 1077-A, and 1078-A contain descriptions, tables of dimensions, etc., of synchronous motor starters for 600 volts or less and also for 2,300 to 4,600-volt service. Starters are of the pushbutton, magnetic type using autotransformer mechanisms for reduced voltage starting requirements and heavy duty contacts for across-the-line starting. The Electric Controller & Mfg Co.

9 TIME SWITCHES: Bulletin T-55 features low-cost time switches designed for the special needs of original equipment manufacturers. Includes pertinent technical information referring to size limitations, switching action, contact rating, mounting methods, adjustability and other desired features. Illustrations, straight-line wiring diagrams, and specifications are also included. Automatic Temperature Control Co, Inc.

10 TRANSFORMERS: Booklet entitled "4 Minutes with Pennsylvania Transformers" gives a quick summary by pictures and word supplements of some of the design and construction features of the company's power transformer. Pennsylvania Transformer Co.

11 TERMINALS: Catalog C-4 contains complete information and engineering data on the company's line of Fusite Hermetic terminals and Hermeticans. Cincinnati Electric Products Co.

12 GENERATORS: Bulletin No. 186 illustrates, describes and gives principles of operation of the new EM "Regulectric" a-c generator. Electric Machinery Mfg Co.

13 ALUMINUM WIRE: Bulletin No. 471 carries information on current-carrying capacity, voltage drop, physical and chemical properties and splicing data. Also contains table making comparisons with copper. Crescent Insulated Wire & Cable Co.

14 COAL DUMPERS: Booklet No. 2048-A, entitled "Rotary Dumpers for Mine and Railroad Cars," describes the company's equipment and its method of operation. Contains many illustrations and sketches which show equipment details. Link-Belt Co.

15 CONNECTORS: Pictorial booklet showing "behind the scenes" techniques used in making connectors. Also contains a graph of the average hourly wages of linemen from 1922 to 1946 and data on how connectors can be used to cut that cost. Jasper Blackburn Products Corp.

Circle numbers, sign and mail — *Coupon good until October 1, 1947 only*

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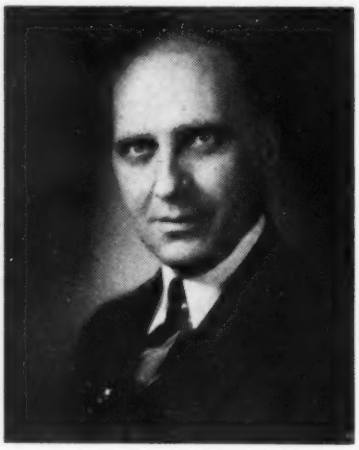
NEWS ABOUT PEOPLE

Milwaukee Utility Assigns Executive Sales Duties

Announcement has been made recently by G. W. Van Derzee, president of the Wisconsin Electric Power Co, Milwaukee, of the following sales personnel changes:

The title of F. A. Coffin has been



I. L. ILLING

changed from vice-president and sales manager to vice-president in charge of sales, in order to broaden his executive responsibilities and to relieve him of certain details of sales activities.

I. L. Illing has been advanced from the position of assistant sales manager to sales manager. In this position he will be in direct charge of all activities of the sales department.

William H. Wagner, formerly industrial sales engineer, has been appointed assistant sales manager. In this position he will assist Mr. Illing in the general supervision of the company's sales activities.

•

▶ EUGENE FREKKO has been named chief engineer of the electrolytic division of Cornell-Dubilier Electric Corp with headquarters at South Plainfield, N. J. He has been with the company ten years and succeeds Paul McKnight Deeley who has been made manager of the plant.

▶ H. E. KING, senior commercial customer representative in West Penn Power Co's eastern division, with headquarters at Greensburg, Pa., has been promoted to supervisor in the commercial customer department, and will be located at Pittsburgh. He succeeds D. W. GROSSHANDLER, who resigned to become assistant sales manager of the commercial cooking division of Hotpoint, Inc, Chicago. H. T. DUTTER, JR., has replaced King at Greensburg.

•

Maryland Utilities Group Elects Crane President

Charles P. Crane, executive vice-president of the Consolidated Gas, Electric Light & Power Co of Baltimore, was elected president of the Maryland

C. P. CRANE

Utilities Association at the recent annual meeting.

Mr. Crane began his service with Consolidated in 1910 when he was employed as secretary in the vice-president's office. He was promoted to assistant to vice-president in 1919, vice-president in 1938 and executive vice-president in 1946.

•

▶ HOWARD G. CARTER has been appointed superintendent of light and power for the Western Division of Puget Sound Power & Light Co at Bremerton, to replace the late A. M. McDonald. With a background education in engineering at the Texas College of Mines, Carter joined Puget Sound at Bremerton eleven years ago as a clerk in the operating department and worked up to assistant superintendent in 1946.

B. E. Schroeder Elected Hotpoint Vice-President

Hotpoint, Inc, has elected B. E. Schroeder vice-president of manufacturing. He was general superintendent of the aviation motor plant, Buick Mo-

B. E. SCHROEDER

tor Co, Melrose Park, Ill., during war time. Since then he has been engaged in production management with Buick at Flint, Mich. He had been with General Motors since his start as a production worker in 1924.

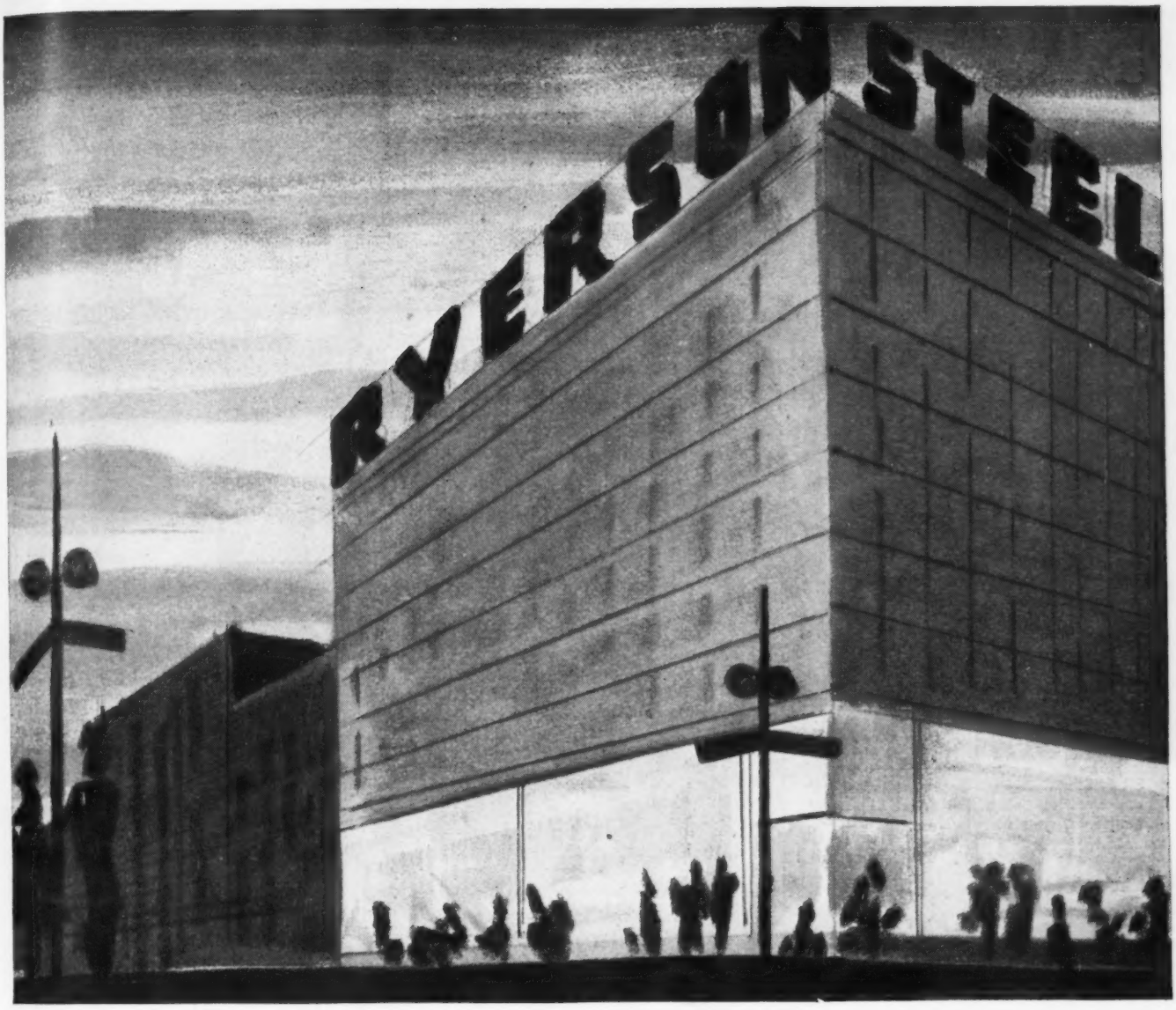
Patrick W. Ryan, for 16 years in Hotpoint plants in Chicago, has been promoted to general superintendent, and M. E. Maurer to general manufacturing engineer from his former work on special technical assignments.

•

▶ JAMES ANDERSON, supervisor of the Minnedosa district of the Manitoba Power Commission, has retired to close an 18-year career with Manitoba's public power utility. A native of Scotland, Mr. Anderson worked in Glasgow as an installation engineer for the Crossley Engine Works. He went to Winnipeg in 1907 to install equipment for the Crossley company.

•

▶ W. J. CLAPP, a veteran of 22 years' service with Florida Power Corp, St. Petersburg, has been made production superintendent of the system to succeed GEORGE TURNER, who has retired after 44 years in the electrical industry, 22 of which were with Florida Power. In recognition of Mr. Turner's service, the



The Department Store Idea

When you think of a Ryerson Plant, picture a huge department store featuring all kinds and shapes of steel. In place of the ordinary sales personnel, think of a large staff of experienced steel men—a sales department that's been carefully trained to guide your steel purchasing—to see that you get the exact steel you need for the job at hand.

And, when you think of Ryerson Steel-Service, think of a smooth-flowing system of steel supply that eliminates every unnecessary delay between order desk and point of delivery. Think of the most modern steel storing, cutting and shipping methods —methods based on more than a century of performance. And remember that Ryerson Steel-Service functions with the same efficiency and promptness whether your order calls for pounds or tons.

Naturally, today's great demand for steel frequently unbalances our stocks. But if the steel you need is not immediately available, we'll gladly do everything possible to supply you with a practical alternate.

What does it all add up to? Well, just about the last word in steel-buying convenience. And it's all yours when you contact a Ryerson Plant for any steel requirement.

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Joseph T. Ryerson & Son, Inc. Plants at: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL

EVERY PROPERTY ESSENTIAL TO METAL JOINING IN ELECTRICAL WORK . . . IS PROVIDED BY SIL-FOS AND EASY-FLO

HIGH CONDUCTIVITY

SIL-FOS and EASY-FLO, the low-temperature silver brazing alloys, make joints equal in conductivity to the metals used for carrying current.

HIGH STRENGTH

SIL-FOS and EASY-FLO produce electrical and structural joints that equal or exceed the parent metals in strength.

DUCTILITY

SIL-FOS and EASY-FLO joints fully equal the parent metals in ability to withstand the stresses and strains of vibration, shock and temperature changes.

CORROSION RESISTANCE

SIL-FOS and EASY-FLO joints offer strong resistance to the usual corrosive agents.

LOW TEMPERATURE

The low working temperatures of SIL-FOS (1300°F) and EASY-FLO (1175°F) minimize the possibility of heat damage — which gives them a big advantage for joining light gauge metals.

ECONOMY

The low-temperature, extreme fluidity and silver content of SIL-FOS and EASY-FLO combine to save labor, alloy, gases and finishing. Cost per joint is surprisingly low.

BULLETIN 12-A

gives full details plus a lot of helpful metal joining information. Write for a copy today.

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company has named the former Benson Springs plant the George E. Turner plant. Mr. Clapp started with the Florida Public Service Co as general commercial engineer in Orlando in 1925. He served in the last war with the Corps of Engineers as a major and upon his return to the company he was made production engineer, the position he held until his recent promotion.

•

United Light Names Hughes Director of Purchases

Frank H. Hughes has been named director of purchases of the United Light & Railways Service Co, succeeding the late W. H. Fahrner. Mr. Hughes is widely known in the utility field, having been associated with the North American Light & Power Co and its subsidiaries since April, 1919. Starting as a clerk to the vice-president and general manager, he has handled special assignments and insurance matters for the six subsidiary companies.

F. H. Hughes

During this period (1919 to 1926) he was associated with the Illinois Power Co, Decatur; Missouri Power & Light Co, Jefferson City; Iowa Power & Light Co, Des Moines; Kansas Power & Light Co, Topeka; Central Terminal Co, and the Illinois Terminal Railroad Co, both of St. Louis.

•

▶ H. D. Comstock has resigned as regional director, Region VI, Bureau of Reclamation, Billings, Mont., after 41 years of service in western reclamation. Assistant Regional Director Kenneth F. Vernon was appointed to succeed him.

▶ Dr. B. Richard Teare, head of the department of electrical engineering and Buhl Professor at Carnegie Institute of Technology, has received the George Westinghouse Award for distinguished contributions to engineering

Listed by Underwriters Laboratories, Inc., and Factory Mutual Laboratories.

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Wherever an industry requires the storage or handling of materials capable of bursting instantaneously into an intense and devastating fire, the utmost in fire protection is none too good.

Blaw-Knox Aquatomic Fog Nozzles stop "bad fires" at the start.

These dependable non-clogging and hard hitting Fog Nozzles cool and quench sudden fires in mere seconds.

Install Aquatomic Fog Nozzles where the hazard is the greatest for 100% dependable protection.

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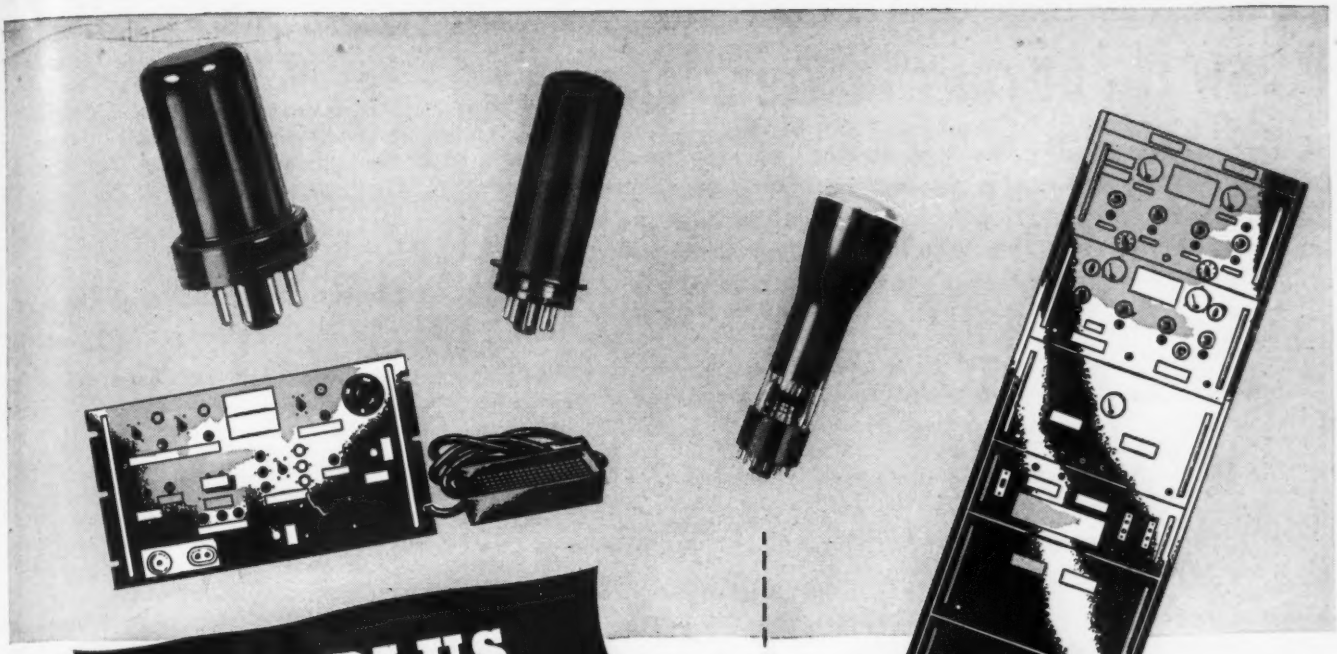

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Purchasing of this equipment has been simplified to a high degree. The WAA Approved Distributors listed at right were appointed on a basis of their ability to serve you intelligently and efficiently. Write, 'phone or visit your nearest Approved Distributor for information concerning inventories, prices and delivery arrangements. You'll find you can "Save with Surplus."

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Heights Station

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HOW IMPORTANT IS WIRE TENSION?

That's a question with only one possible answer. Even the costliest construction is only as good as the final wire job. If questionable "sight and sag" or "oscillation" methods of tension indication are employed, no two men see exactly the same thing. Wherever the human element is depended upon, chances for error are ever-present.

A scientific Dynamometer reads the same every time. It is calibrated on laboratory equipment that is itself accurate to 1/2 of 1%. Even the "greenest" hand can secure perfect tension on the very first try. No chance for a "maybe" or "perhaps" answer. It's right because it is right!

***PRE-STRETCHING** with a Dynamometer is simple. The stretch in "green" wire is quickly removed by pulling it up to the percentage recommended by the manufacturer. Time saved by this operation alone is a big factor in cutting construction costs.*

***FREE WIRE STRINGING DATA SHEETS** have been compiled by Dillon Engineers from questions submitted by leading utilities. Write for yours today. Illustrated Dillon Dynamometer catalog will be included.*

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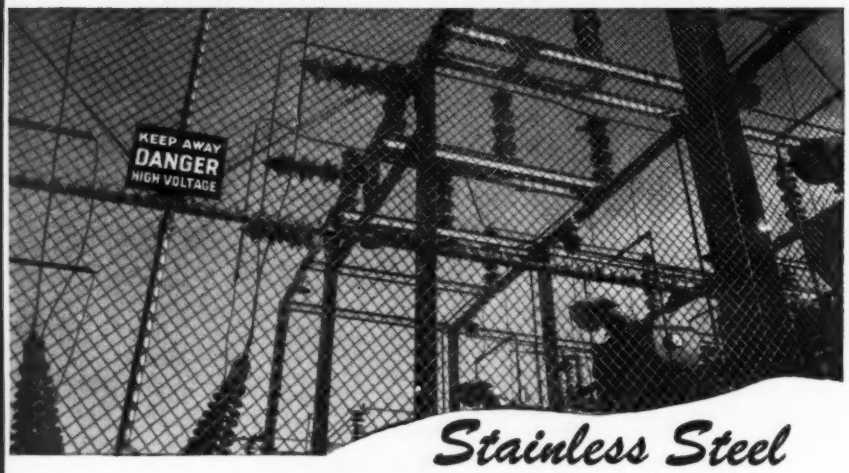

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education from the American Society for Engineering Education. The award of $1,000 was established in 1946 by the Westinghouse Educational Foundation as a part of the centennial celebration commemorating the birth of George Westinghouse.

•

Ebasco International Names Tassie Mexican Sponsor

Announcement has been made by Ebasco International Corp, New York, of the appointment of R. W. Tassie as operating sponsor for Mexico. In this capacity Mr. Tassie is succeeding Lyman P. Hammond, who has been operating sponsor for the Mexican properties of American & Foreign Power Co, Inc, since 1928.

Mr. Tassie's extensive experience in the electric light and power industry in Latin American countries dates from 1911 and embraces operations in Cuba, Venezuela, Brazil and Guatemala, as well as other countries. In 1944 he was transferred from the position of president and general manager of the American & Foreign Power Co's subsidiary in Guatemala to the former company's offices in New York.

Mr. Hammond entered the public utility field in 1910 as sales manager for the Central Colorado Power Co and, upon the reorganization of that company as the Colorado Power Co, shortly thereafter became general manager, then president, serving in that capacity until 1924 when the company was acquired by the present Colorado Public Service Co and Mr. Hammond entered the Electric Bond & Share Co's organization, of which he was a vice-president from 1926 until 1936. He has been president and director of Mexican Electric Companies, Inc, a sub-holding company for the Mexican interest of American & Foreign Power Co, and a number of the operating subsidiaries of the Mexican utility. He also was a vice-president and a director of Ebasco International Corp, with which he will continue his association for an indefinite period in a consulting capacity.

•

► L. W. BYRON, formerly merchandising supervisor for the Wisconsin Power & Light Co, has been appointed residential sales manager, succeeding Frank J. Cottrill, retired. Mr. Byron has been identified with the Madison properties since 1930.

► FRANCIS H. LACY, JR., of Marble Falls, Tex., has been added to the territorial development staff as agricultural economist for Monongahela Power Co. Mr. Lacy is a graduate of

When HEAT is Cooking Your Cable...

Prevent Failures with ROCKBESTOS A.V.C.

What goes on *inside* conduit exposed to the heat of boilers, steam lines, ash pits and other cable-cookers can't always be accurately calculated. If ambients rise above normal for long periods or loads run higher than anticipated, *copper temperatures go up* and you're in for trouble if the cable can't take it.

For an ample safety factor against such conditions and unpredictable peak-boosting emergencies, wire with Rockbestos A.V.C. It will take operating temperatures up to 230° F. *continuously* without deteriorating — has ample moisture resistance to withstand condensation from heating and cooling cycles — and its impregnated asbestos insulation gives you a plus value in greater current carrying capacity.

You can get Rockbestos A.V.C. Power Cable in 600 to 5000 volt ratings — single or multi-conductor — with asbestos braid, lead sheath, armor, or lead and armor. Also Type AVA Lighting and Control Wire, Type AVB Switchboard Wires and Multi-Conductor Control Cables. For information or recommendations write the nearest district office or:

ROCKBESTOS PRODUCTS CORP., 215 Nicoll St., New Haven 4, Conn.

QUICK Facts About LONGER Cable Service

Type AVA, Rockbestos A.V.C. 600 Volt Power Cable illustrated (No. 18 AWG to 2,000 MCM) and similarly insulated Motor Lead Cable have a maximum operating temperature of 230° F., and this failure-preventing construction:

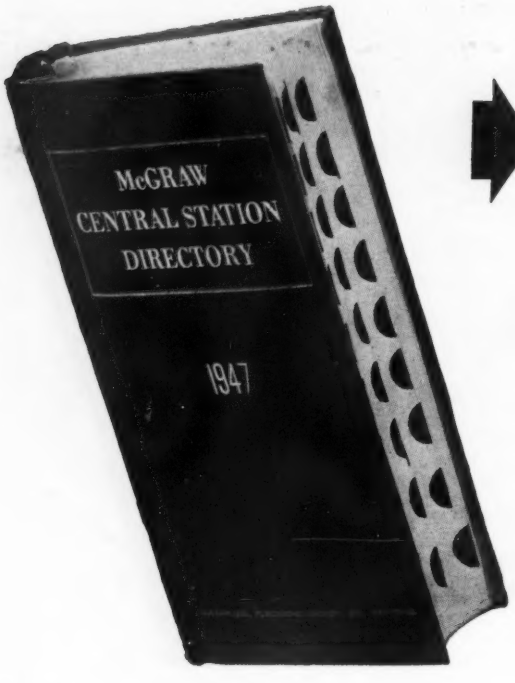
- Age-resistant impregnated asbestos braid that resists heat, flame, moisture, oil, grease and corrosive fumes.
- Outer wall of felted asbestos insulation, impregnated with heat, flame and moisture resisting compounds, won't dry out, crack, flow, rot or burn.
- Asbestos-protected varnished cambric for high dielectric strength and added moisture resistance.
- Inner wall of impregnated felted asbestos withstands conductor-heating overloads — won't bake brittle or burn and helps provide greater current carrying capacity.
- Conductor is perfectly and permanently centered in helically applied non-flowing insulation.

One of 125 different constructions designed by Rockbestos for severe or unusual operating conditions. Others include lighting and switchboard wires, multi-conductor control and power cables, and lead sheath or armored constructions.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND PITTSBURGH DETROIT CHICAGO ST. LOUIS LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.



Presenting the 1947 edition of the

McGRAW CENTRAL STATION DIRECTORY

●

This latest, most accurate coverage of changes in electric utility operations and personnel is published for those who work in or sell to the electrical utility industry.

●

The 1947 edition of the McGraw Central Station Directory lists in one compact volume every discoverable change in the electric utility industry during the past 12 months. Changes in personnel and operations up to April 1, 1947 and other exclusive data on organization, areas served, generation and distribution equipment are included for each of 4,000-odd utility plants in the U. S., Canada and U. S. possessions.

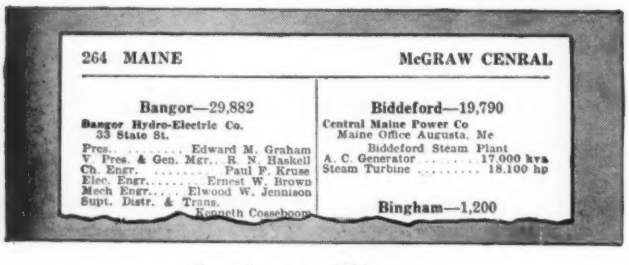
Facts Presented:

1. Names and addresses of private and municipally operated electric light and power companies in the U. S., Canada, and U. S. possessions; also government-controlled projects.

2. Names and addresses of affiliated, holding, controlling or managing and service companies with complete lists of properties controlled or managed by each, and including names and addresses of principal officials.

3. Names and addresses of officials and chief operating men for all operating companies, including:

- Presidents
- Vice Presidents
- General Managers
- Superintendents of Distribution
- Mechanical Engineers
- Commercial or New Business Managers
- Superintendents of Transmission
- Plant Superintendents
- General Superintendents
- Purchasing Agents
- Division or District Superintendents
- Chief Engineers
- Electrical Engineers
- Plant Engineers
- Merchandising Managers
- Division or District Managers


264 MAINE — McGRAW CENRAL

Bangor—29,882
Bangor Hydro-Electric Co.
33 State St.
Pres. ..... Edward M. Graham
V. Pres. & Gen. Mgr.. R. N. Haskell
Ch. Engr. ..... Paul F. Kruse
Elec. Engr. ..... Ernest W. Brown
Mech Engr.... Elwood W. Jennison
Supt. Distr. & Trans. Kenneth Cossehoom

Biddeford—19,790
Central Maine Power Co
Maine Office Augusta, Me
Biddeford Steam Plant
A. C. Generator ..... 17,000 kva
Steam Turbine ..... 18,100 hp

Bingham—1,200

Sample page of Directory.

REA Co-ops Listed:

REA co-operatives are again listed separately in the back of the Directory. This list includes new co-operatives energized during the past year.

Use by Utilities:

The directory is used by hundreds of utility executives who wish to know about:

1. The organization of other utilities, especially those in their own or adjoining areas.
2. Movements of officials from company to company.
3. Discernible trends in expansions of operations of other utilities.

Use by Manufacturers:

Manufacturers of electrical generating, transmission and distribution equipment, and manufacturers of general equipment and supplies, all serving the vast utility industry, make constant use of the directory for

1. Names and addresses of executive, supervising, managing and engineering officials.
2. Determining electrical characteristics of plant, equipment and lines now in use.
3. Knowledge of scope of operations: generating capacity, towns and number of meters served, etc.
4. For each operating company, the following information is presented:

- Company total and plant individual generating capacity in kva. or kw.
- Kind of prime mover and capacity in hp.
- Amount of power purchased in kw hrs.
- Type of current distributed, No. of wires, phase, voltage and cycle.
- No. of meters served.
- Location of power plants.
- Complete list of towns (of 500 population or over) served.
- A complete alphabetical index of companies listed.

Edition Limited:

Shortage of paper and binding facilities again necessitates limiting the 1947 edition. Orders will be filled in order of receipt. The Directory is sturdily bound in flexible blue Fabrikoid, fully thumb-indexed, size — 4½″ x 8½″. Price $30.00 per copy. 10% discount on 5 or more copies. For intelligent, productive planning and selling, a copy of the 1947 edition of the McGraw Central Station Directory should be in the hands of every executive responsible for such plans.

Send orders to

McGraw Central Station Directory
McGraw-Hill Publishing Company
330 West 42nd Street, New York 18, N. Y.

Texas A. & M. College and recently completed work on a master's degree in farm management and agricultural economics at Purdue University.

▶J. E. RILEY, superintendent of public utilities in Roseville, Calif., has resigned and will return to his former post as head of the municipal water department. No explanation was given for his action. He had been utilities superintendent since 1939, when the position was created, having been municipal water department head since 1934.

OBITUARY

George W. Cato

George W. Cato, formerly superintendent of the electrical system of Detroit Edison Co, died recently at his Santa Barbara, Calif., home. He was a close friend of the late Henry Ford and the inventor of many electrical devices.

After working for an electrical appliance manufacturer in Detroit, Cato, then only 15 years old, went to work for the Edison Illuminating Co in the same city. In 1889, at the age of 17, he became chief electrician for the company and headed the electrical department until the formation of the Detroit Edison Co, when he was made general superintendent in charge of electrical operations. He held this position until his retirement in 1927. Since his retirement, he has acted as consulting electrical engineer for the company.

During the early days when certain electrical devices were desired but not obtainable, he would not only design but build a suitable one. Included among these were telephones, carbon brushholders for dynamos and motors, a combination switch and fuse for Edison d-c feeders, and the first successful 5-kv fuse, which type is still in use by the company.

When Henry Ford, then chief engineer for the utility, was experimenting and building his first auto, he constantly consulted young Cato.

•

▶CHARLES PAGET GOLDING, 43, sales manager of the New Bedford (Mass.) Gas & Edison Light Co, lost his life on July 18, while piloting an airplane near that city. He was a son of the late Frank H. Golding, former president of the New England Gas & Electric Association, and had been located at New Bedford for about ten years with the exception of three years' service as a U. S. naval officer in World War II. Earlier Mr. Golding was in charge of sales promotion activities for the Western Massachusetts Electric Co. system with headquarters at Springfield. He was educated at the University of Cleve-

Kilowatts on the night shift

The best new workers on your night shift are General Electric Automatic Blankets.

When most appliances knock off for the night, these automatic blankets go to work—*real load builders for your off-peak hours.*

Over half a million enthusiastic people are using General Electric Automatic Blankets today—and every two blankets use just as many kilowatt hours as one six-foot refrigerator.

We're telling *your* customers the exciting story of these blankets through full-color advertisements in *Life*, *House Beautiful*, *Good Housekeeping*, *Time*, *This Week*, and *National Geographic*.

You profit when you tell them, too.

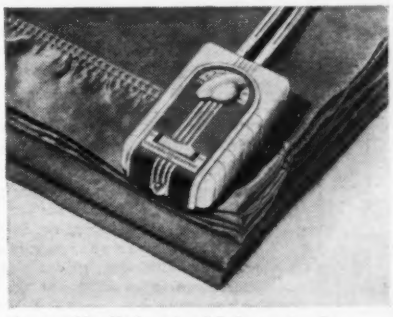
Tell them that the original General Electric Automatic Blanket is now available in three models.

Tell them about the exclusive new Two-Control Automatic Blanket for double-bed luxury.

Tell them about the wonderful One-Control Blanket—and the brand-new Twin-bed size.

Because every one of these blankets in your area means more kilowatt hours on *your* night shift.

Write to us for full information, *today*. We'll give you all the tips on how to cash in on this great load builder. Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Conn.



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GENERAL ELECTRIC

finishing cloths flat or formed

packed 16 cartons

CABLE-SPLICERS WIPING CLOTHS

Select herringbone ticking has no equal

Wiping Surfaces Treated; Ready For Use

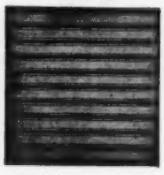
REQUIRE NO BREAKING-IN

Wipe Perfect Joints

on lead-sheathed cable splices

Write for literature & prices

catch cloths



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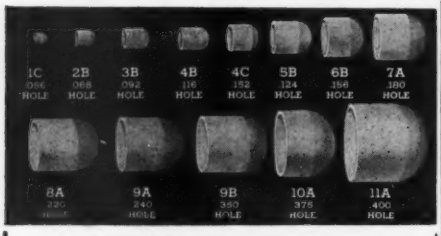
GEO. E. WILLIAMS, Mfr.

3035 Aldrich Avenue So. Minneapolis 8, Minn.



STAR INSULATING BEADS

Use LOVALAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.

51 Muirhead Ave. Trenton, N. J.

STAR PORCELAIN COMPANY, Ltd.
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New COOL-AMP Method

SILVER PLATING

on the job!

COOL-AMP means better and cool connections for copper bus bars, current transformers, fuse clips and blades, cable terminals, large building service switches, etc. Can be carried in every electrician's tool kit. Safe and simple to apply. Ready for instant use.

Used by most Pacific Coast Utilities, Gov. Power Adm. and industrial plants

One lb. "Cool-AMP" silver plating powder will plate 6,000 sq. in. $11.50 lb. Four 1-lbs. @ $11.00 lb. Cost—less than 1c per 5 sq. in.

Write *Sample sent upon request.*

The **COOL-AMP** *Co.*

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land, Williams College, and the Harvard Graduate School of Business Administration.

•

Frederic W. Darlington

Frederic W. Darlington, 82, retired electrical engineer, died July 24, in a hospital at West Chester, Pa.

A native of Altoona, Pa., he was graduated from the Sheffield Scientific School of Yale University. He joined Westinghouse Electric Co soon after its incorporation. After supervising street railway construction in a number of cities, the company sent him to Tokyo, where he spent 18 months supervising the electrification of the city.

In 1892, Darlington became chief engineer of the Philadelphia Traction Co, now known as the Philadelphia Rapid Transit System, and was in charge of converting 450 miles of horse-car and cable-car trackage for electrical operation.

From 1894 to 1907, he was a consulting engineer for the City of Philadelphia and during that period was hired by the Pennsylvania Railroad to electrify its Burlington-Mt. Holly, N. J., line.

During World War I, he served with the Army Engineers and was on General Pershing's staff.

In later years, he devoted much time to the illumination of fountains throughout the world.

•

▶ WILLIAM E. BLODGETT, 63, controller and treasurer of the Winnipeg Electric Co, died July 19 at Winnipeg, Canada. Before joining the Winnipeg utility in 1920 as controller, he had worked for the Twin Cities Rapid Transit Co of Minneapolis and St. Paul and for the Utah Light & Traction Co, Salt Lake City.

▶ J. W. LOVEJOY, superintendent of the Laurens (S. C.) waterworks and electric light plant, died on June 23 in Greenville, S. C., following a short illness. Born in Chicago, he had been a resident of Laurens for 21 years.

▶ J. C. MUNRO, manager of the general sales division, B. C. Electric Railway Co, Vancouver, B. C., died recently after a month's illness. Mr. Munro joined the B. C. Electric in 1927 as assistant sales engineer and was promoted to light and power sales manager in 1945. Early this year he became manager of general sales.

▶ JOHN C. WELSH, manager of the Sebring (Ohio) branch of the Ohio Public Service Co, died on June 2 in his fifty-sixth year. Mr. Welsh was with the company for 25 years.

"QUIET JUNIOR! Daddy's doing his homework"

Junior's old gent is a busy man.

He has to have plenty of "know-how" to keep on top of his job.

Sometimes it takes home-work to keep abreast of things and right now he's reading this issue of this McGraw-Hill magazine—the one you are holding in your hand.

Obviously, he's not looking for glamour, amusement, or entertainment. *He is strictly on the make for ideas.*

He wants to know what the other fellow is doing — what's new in methods and processes that will help him do a better job.

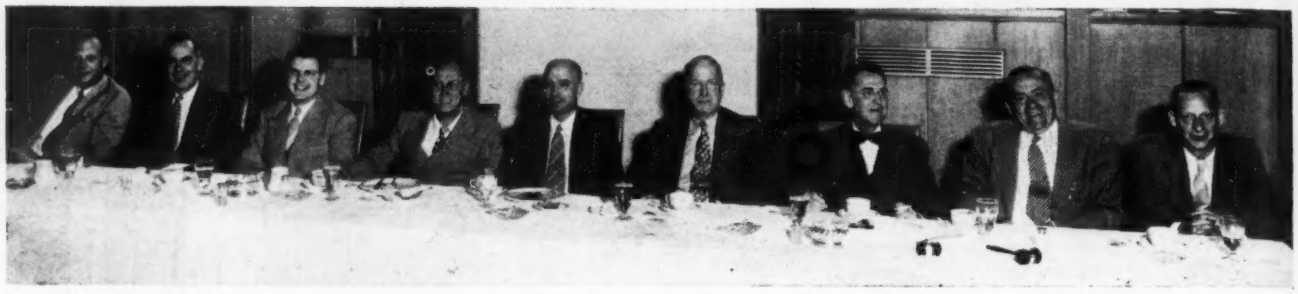
He's an avid reader of the ad-pages as well as the editorial content. The advertisements along industry's shopping street give him an opportunity to inspect the products and services of America's leading manufacturers — and he examines them with an eye to what they can do for him.

Yes — Junior's old gent is a busy man. But he never misses a trick!

To keep in touch with the parade • • • read the ads.

F-4

MANUFACTURERS & MARKETS



THE MEETING THAT BROADENED MANAGEMENT—Supervisory employees of the Line Material Co at the dinner at which the Line Material Advisory Management Organization was formally recognized. Pres. W. D. Kyle is third from right

Line Material Co Organization Extends Management to Supervisory Employees

Because a group of supervisory employees of the Line Material Co couldn't hold a Christmas party without talking business, management at the company has taken on a far broader meaning than it has at most other companies.

Two years ago some 20 supervisory employees at a Christmas party got into a discussion about the company. The party didn't last long enough; so other meetings followed with the resulting ideas being passed along to top management. W. D. Kyle, president, encouraged the informal group; so it continued its work, taking up many projects of importance to the firm, management, and employees.

Last month the group received formal recognition by the company as the Line Material Advisory Management Organization whose efforts will be directed to getting ideas of employees to top management.

At present the organization is set up only at the South Milwaukee and Barton plants but probably will be extended to plants at Zanesville, Ohio; East Stroudsburg, Pa.; Oneida, N. Y.; Birmingham; and Kansas City, Mo.

Each of the two plants has a ten-member board appointed by an officers' committee. The members serve for one year with five retiring every six months. This allows more employees to serve and gives them valuable experience. The board elects its chairman and secretary, meets semi-monthly, and works on its own or assigned projects.

The board chairmen and secretaries form the executive council, which meets monthly. This group coordinates the work of the boards and passes their recommendations in finished form to the officers' committee, consisting of vice-presidents and the treasurer of the company.

There is no limit to the organization's activities. A project may concern the entire company or one plant or department. Projects which have been completed or are under study include:

Personnel department for the company, profit sharing plans, group insurance, policies governing membership of employees in technical and professional organizations, vacation policies, stock purchase plans for employees, engineering standardization of parts, market analysis, employees' manual, and principles of coordination of home office and branch plants.

•

Heat Pump Water Heater Being Tested by Hotpoint

The application of a heat pump to an automatic water heater has been announced by Hotpoint, Inc. At present only in the experimentation stage, the pump will draw heat from the air into freon gas which will be compressed to raise its temperature. It is believed that but one-third as much electricity as a conventional water heater uses will be needed to bring the contents of an 80-gal. tank to 150 deg.

2nd International Lighting Show Program Revealed

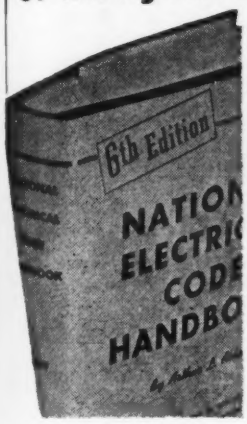
Details of the forums and conferences planned for the 2nd International Lighting Exposition to be held in Chicago on November 3-7 have been released by the Exposition Operating Committee. "Planning Today for Tomorrow's Lighting" keynotes the show. This theme is further advanced by a scheduled series of five morning meetings aimed at discussing the newest developments in lighting equipment and application techniques.

Among these discussions and presentations will be "What's New in Lighting," by George Whitwell, vice-president, Philadelphia Electric Co; H. E. Murphy, Stone & Webster Engineering Corp; and D. G. Mitchell, president, Sylvania Electric Products, Inc; "How to Make the Planned Lighting Program Work," Merrill Skinner, Union Electric Co of Missouri, and "NEMA Plans for Lighting Promotion," E. C. Huerkamp, sales manager, Lighting Division, Westinghouse Electric Corp.

Axel Kahn, District Manager, General Electric Supply Corp, H. P. Litchfield, assistant general sales manager, Graybar Electric Co, and J. M. McKibben, assistant to vice-president, Westinghouse Electric Corp, will present the latest developments in marketing, planning and merchandising lighting equipment and training salesmen. Also scheduled are Leo Gamp, Gamp Electric Co, Warren W. Langstrom, Jack Stone Electrical Co, and Ward Harrison, manager, Engineering Division, General Electric Co, who will discuss contractors' selling plans, service maintenance plans, and how to "Light Beyond Tomorrow."

According to the Exposition manage-

How to handle all kinds of wiring and installation jobs . . .



in strict accordance with the latest

NATIONAL ELECTRICAL CODE

HERE is the long-awaited electrical contractor's job-book—the first revision in six years—almost completely re-written in accordance with the new 1946 Code requirements and planned to enable electricians to understand the new rulings of the National Electrical Code and to do work in accordance with it. It restates involved rules in simple language; it provides explanations, furnishes practical directions, and is filled with diagrams showing what the Code rules mean and how to apply them. A special arrangement groups rules, making it easy to find all the rules applying to any given job.

Just Out — Sixth Edition

NATIONAL ELECTRICAL CODE HANDBOOK

By ARTHUR L. ABBOTT
616 pages, 5 x 7½, 418 illustrations, $4.00

Based on the 1946 Code
•
Adopted as 1947 Code

This handbook is one of the most unusual and helpful electrical books published. It gives a wealth of information from the practical angle of getting jobs done according to code requirements. It saves delay in starting jobs, it saves time and money in avoiding false starts, errors and violations. At the same time it contains so much clearly presented information that it will pay to use it for general reference on many questions of materials, plans, wiring, and installation.

All rules for a job grouped in one place

Once you have looked up a rule in this handbook, you may rest assured that you will not find later that there was *another* rule to be considered and that the job will have to be done over. It reduces a maze of scattered rules to a logical and understandable system.

Shows what the code means and how it applies to:

- commercial buildings
- homes
- factories
- outside work
- emergency lighting
- high-voltage equipment
- signal systems
- motor installation
- services
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Investigate . . .

THE FISHER-PIERCE PHOTOELECTRIC CONTROL FOR MULTIPLE STREET LIGHTS

NEW LIGHT ON THE PROBLEM OF STREET LIGHTING

The Fisher-Pierce Company — specialists in electronic applications — offer a new control — a simplified Automatic Photoelectric Unit for Multiple Street Light Control.

The interest already shown by hundreds of utilities in such a development centers around these features:—

1. **Flexibility** — individual street lights can be connected directly to 117-volt distribution lines.
2. **Lower Costs** in service and maintenance compared with other methods of control.
3. **Quality** of lighting service secured.

With FISHER-PIERCE PHOTOELECTRIC CONTROL it is possible to preset the value of illumination at which it is desired to turn on the lights— lights so controlled will go on at that value of illumination day after day regardless of specific location, weather conditions, or obstacles.

Technical Characteristics & Features — This control operates dependably down to less than 1 foot-candle. It has a built-in differential and time delay to avoid operation by lightning, clouds or cycling— absolute minimum of components.

Maintenance Procedure — Routine maintenance necessary only once per year— In addition to its technical advantages, plug-in replacement eliminates the need for service on the pole and permits full utilization of skilled technician's time.

Installation— Heavy galvanized mounting bracket fastens directly to distribution pole.

This low cost control has received wide acceptance by farsighted lighting engineers. Over 1600 controls have been under field test by 250 utilities for periods up to two years throughout this country and abroad.

Write for Bulletin FP61300 for further information.

Units can be shipped from stock.

FISHER-PIERCE COMPANY
82 CEYLON ST., BOSTON 21, MASS.

Here's what to look for in TAPE!

CORRECT UNWINDING TENSION
NON-RAVELING—CLEAN CUTTING
HIGH TENSILE STRENGTH
TIGHT STICKING—FAST HOLDING
GOOD DIELECTRIC QUALITIES
STRAIGHT, EASY TEAR-OFF
GUARANTEED FOOTAGE

You will find all these qualities in ACCURATE tapes. ACCURATE tapes — friction and rubber — are made in the modern ACCURATE plant devoted exclusively to the manufacture of fine electrical tapes. Although ACCURATE tapes are produced to exacting standards under rigid quality control and from the finest materials obtainable they cost no more than other tapes.

Electricians know good tape makes their work easier and faster. Good tape—ACCURATE tape—handles fast and easy. It makes smooth joints that can't be beaten. ACCURATE tapes are real time and money savers and every roll is guaranteed for full footage. Ask for it by name—ACCURATE.

ACCURATE MFG. COMPANY
General Offices & Plant: Garfield, New Jersey

ment, the conference sessions are open to all who are entitled to admission to the Exposititon and advance registration is urged.

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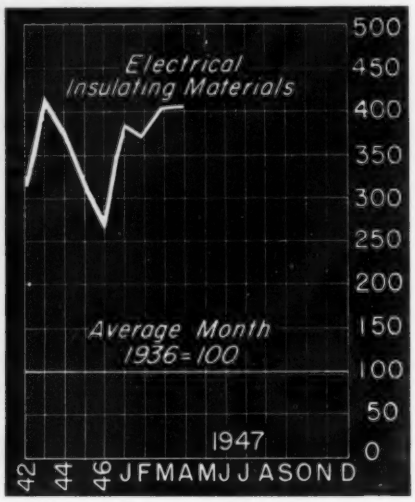
Insulating Materials Sales in April Hold March Line

Sales billed on electrical insulating materials during the month of April remained unchanged from the preceding



month, the index compiled by the National Electrical Manufacturers Association holding the March line at 405. The index stood at 373 in February. This year's figure represents an increase of 80 percent over April, 1946, when the index reached only 225.

The monthly index of orders received of motors and generators is being revised to a quarterly basis. The revised index will be released quarterly beginning with the second quarter of 1947.

•

Manufacturers Make New Salees Assignments

Electrical manufacturing companies have made the following sales appointments:

MONSANTO CHEMICAL CO, St. Louis, has assigned Harvey M. Harker to the general branch managership of the recently established sales office for the state of Texas with headquarters in Houston.

FOSTER WHEELER CORP has appointed J. H. Bell sales manager of the company's newly created Dallas district. Mr. Bell was formerly assistant vice-president of the corporation and head of its public relations and advertising department. Mr. Bell will be in charge of a district that embraces parts of Texas, Oklahoma, Mississippi and all of Arkansas.

ALL-STATE WELDING ALLOYS CO, INC, White Plains, N. Y., has assigned Richard T. Spear to a regional sales managership. His territory includes eastern Pennsylvania, southern New Jersey, Virginia, West Virginia, Delaware, Maryland and the District of Columbia.

INSULATED BRUSH

For cleaning around electrical apparatus in Power Plants and Sub-Stations.

Handle of selected straight grain wood with high quality, specially designed 11" brush. Eight inch non-conducting fibre surface beyond the hand guard protects against slipping and possible contact with current or apparatus.

The best of materials are used and the workmanship is thorough. Length 36".

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Recent Rate Changes

RIPLEY (TENN.) POWER & LIGHT CO, acting upon the recommendation of the Tennessee Valley Authority, has reduced its electric rates approximately 12 percent. In a congratulatory letter to J. S. Scott, Mayor of Ripley, George F. Grant, general manager of TVA, said in part, "the adoption of these new rate schedules will save the electric consumers of your distribution system approximately $14,500 a year. . ."

ELAINE UTILITIES CO, Helena, Ark., rate structure will fall under the scrutiny of the state Public Service Commission, which has ordered an investigation not only of rates but of services and practices as well.

BOONVILLE (IND.) municipal light and power utility went under fire at a public hearing early this month when the state Public Service Commission declared that rates charged are illegal. Mayor William Stevens was directed to submit to the commission within 30 days all costs of operation of the municipal plant. Public hearing was brought about by a group of local citizens who objected to an ordinance passed by the city council last November which increased power and light rates substantially. The council stated the increase was necessary because of increased operating expenses. The group asked the commission to investigate and set a proper rate. Members of the city council contended, however, that the commission had no jurisdiction over setting rates for a municipally owned plant. Since the plant has been owned by the city, rates have been set by the city council and have not been sent to the commission for approval. The plant was purchased from the Southern Indiana Gas & Electric Co. in 1941. At the time the citizens' petition was filed with the commission, the latter went to the attorney general for an opinion as to whether or not the commission had jurisdiction. The attorney general's opinion in part stated: "It is my opinion that a municipality now owning or operating a utility is subject to the jurisdiction of your commission for the purposes of fixing rate to be charged patrons of such utility for service."

CADDO ELECTRIC COOPERATIVE, Binger, Okla., has recently reduced its monthly rates 50 cents, effective July 1. Under the new rate schedule the minimum charge becomes $3 monthly instead of $3.50, with the number of kwhr remaining the same.

•

3 Public Power Utilities Get FWA Planning Loans

The Federal Works Administration has made loans to two municipalities and a peoples utility district to plan new power facilities.

Sioux Center, Iowa, received $3,650 to plan a municipal power plant and distribution system to cost an estimated $175,000.

Bonners Ferry, Ida., received $19,500 to plan improvements to its municipal hydro system at an estimated $257,500.

Tillamook (Ore.) P.U.D. received $20,000 to plan a $430,000 expansion of its distribution system.

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Conductor Size B. W. G.	Type of Construction	Diameter of Conductor (inches)	Minimum Breaking Strength (lb.)
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6	3-wire	0.252	4295
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6	Solid	0.203	4208

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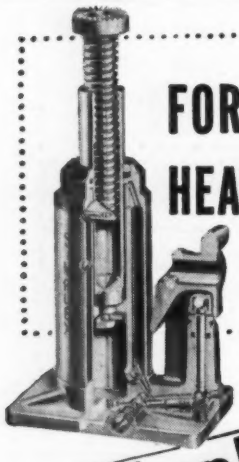

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BOOK REVIEWS

An Introduction to Engineering Plastics. By D. W. Brown and W. T. Harris. Published by Murray Hill Books, Inc., New York 16, N. Y. 274 pages, illustrated. Price $4.

For the engineer who can advantageously apply plastics, here are their properties and limitations in such quantitative degree as to afford ample basis for intelligent selection and adaptation. The various plastics are classified chemically, there are curves of generic characteristics, tables of specific properties, discussions of fatigue and creep and enumeration of standard tests. In addition there is a chapter on the high-frequency preheating techniques. An appendix lists the trade names in conjunction with the chemical classifications.

Textile Fibers. By J. M. Matthews and H. R. Mauersberger. Published by John Wiley & Sons, New York, N. Y., 1133 pages, illustrated. Price $12.50.

While primarily pertinent to the textile industry, this large-scale revamping and revision of the 1924 edition does have specific significance to those who use textile fabrics and tapes for their electrical-mechanical properties. It deals essentially with the processing, characteristics, potentiality and vulnerability, identification and testing of silk, cotton, synthetic, inorganic (glass, asbestos) fibers as well as the wool and others seldom used for electrical purposes. Aspects which will definitely be helpful to electrical manufacturing engineers and the users of their products are the authoritative discussions of moisture, ignitability, reaction to heat and chemicals, effect of oil and microbiological exposures. Fibers are classified and yarn measures and various standards have been set up and recorded here as further elements of valuable and authoritative reference.

Radar Engineering. By Donald G. Fink. Published by McGraw-Hill Book Co., New York 18, N. Y. 644 pages, illustrated. Price $7.

For the electrical engineer who has any understanding whatever of electronic circuits, the first comprehensive treatment of radar will prove uniquely informative about this war-bred technic. The author was intimately concerned with the development and clarification of the art and was thus enabled to interpret the fundamentals and the applications as soon as the subject matter was declassified by the military. Pulse generation, transmission, reflection and reception are coming more and more into the art of fault detection and communication on power circuits and, therefore, the electrical engineer committed to frequencies in the tens of cycles could well know about the usefulness of superposed or imposed pulses in kilo- or megacycle brackets. It will be of avail also in case radar proves fully practicable in detecting the approach of disruptive electric and wind storms. Anyone who dodged the challenge of carrier currents, impulse generators and electronic controls because his heart was set on 60 cycles has a new challenge facing him in radar. The book in question affords an excellent grasp of the new tool.

Tables of Integrals and Other Mathematical Data. By H. B. Dwight. Published by The Macmillan Co. New York. 250 pages, illustrated. Price $2.50.

In this first revision since 1933 there have been added several new groups of

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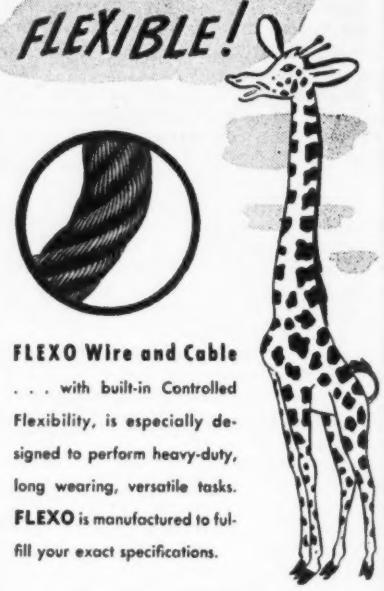

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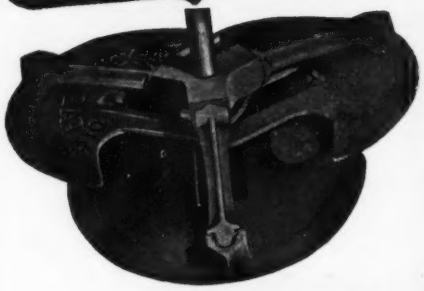

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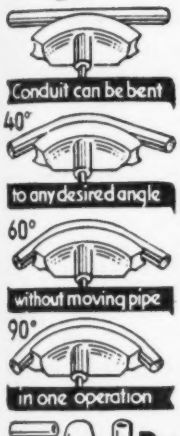

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Men and Volts at War. By John A. Miller. Published by McGraw-Hill Book Co., New York. 272 pages, illustrated. Price $3.75.

This Whittlesey House book is more than the story of General Electric contributions to World War II—it is a broad picture of the technology in widely diversified fields that made victory inevitable. The recital ranges from the powering of the Navy and the Merchant Marine to the perfection of the magnetron that aided in jamming enemy radar. Between these extremes there are tales of welding that saved disabled ships, of winches that righted the *Oklahoma* at Pearl Harbor, of phenomenal speed in equipping huge floating dry-docks, of the degaussing installations that thwarted the magnetic mines, of the supercharger program. For the air service there were jet engines, automatic pilots for the B-29, turret controls, heat suits and goggles for the flyers. Development of the bazooka, the smoke generator and shell fuses are samples of contributions to the ground forces along with mobile power plants, radar and gun control. One whole chapter is devoted to the task of reenforcing the utility power systems of the nation and another to atomic energy research.

The large number of excellent photographs in themselves make a superb pictorial history of the technological aspects of the war.

Guide to the Literature of Mathematics and Physics. By N. G. Parke III. Published by McGraw-Hill Book Co., New York. 205 pages. Price $5.

This book will be welcomed by many an engineer who is conscious of two things: (1) his desire to "read up" on some newly pertinent topic and (2) his limited capacity to fix on an approach. This common weakness of engineers and science students is the author's incentive. He provides a two-pronged solution by discussing the methods of choosing the most profitable approach among texts and handbooks, and then listing some 25,000 or more specific references. The latter are classified under mathematical, chemical, electrical and physics topics ranging from "adsorption" to "x-rays." Most of the references are to sources made available in the last two decades.

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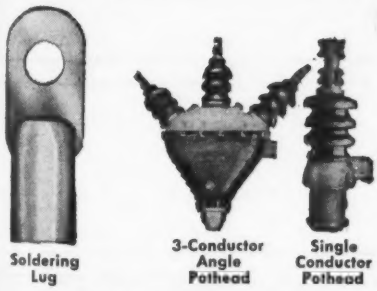

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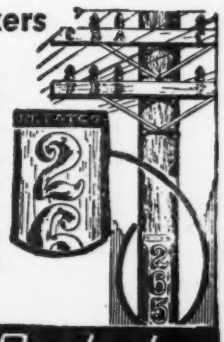

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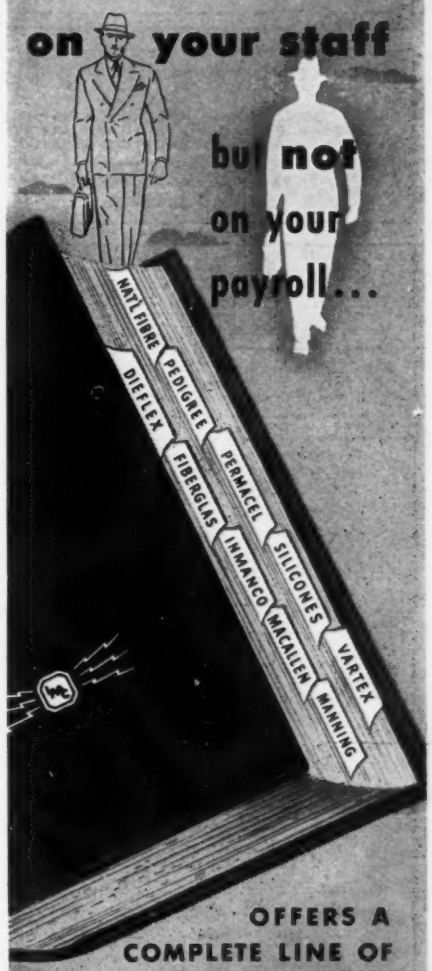

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